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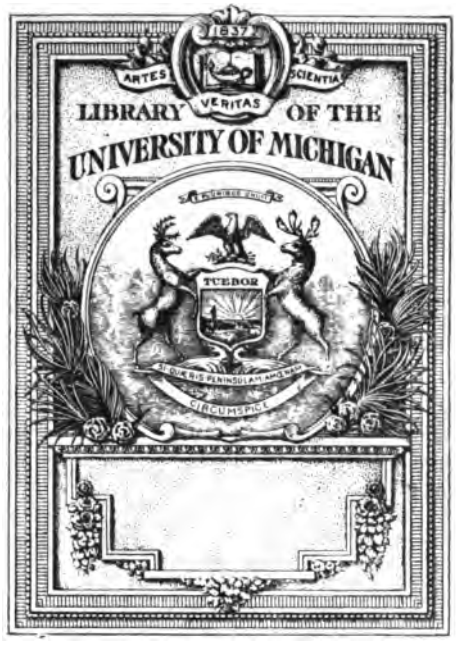

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MEMOIRS

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MEMOIRS

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VOL. V.

FOR THE YEARS 1823–24.

PART I.

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MEMOIRS, *&c.*

I.—*An Account of the* Foramen centrale *of the Retina, generally called the* Foramen of Sœmmering, *as seen in the Eyes of certain Reptiles.*

By Robert Knox, M. D. M. W. S. Med. Ch. Soc. &c.

(*Read* 15*th November* 1823.)

When Dr Sœmmering announced his discovery of a transparent point or *foramen* in the human retina, nearly, or, as some say, precisely in the axis of vision, it excited very strongly the attention of anatomists, and of the philosophic world generally. It was indeed a singular circumstance, that so remarkable, and so easily detected, an appearance should have escaped the observation of the distinguished anatomists who preceded Sœmmering. The public attention having been much roused, numerous researches were immediately instituted by many English and foreign Anatomists, with the view of determining whether this perforation, or transparent portion of the retina, was

peculiar to man, or was extended to other species of vertebral animals. The result of these inquiries, so far as I have been able to collect, is as follows.

—"In Man," (observes Baron CUVIER, *Anat. Compar.* t. ii. p. 422.), "there is, near the entry of the nerve, and almost at the point which corresponds to the axis of the eye, a small fold of the retina, which forms a slight convexity, when the more external membranes are removed. In the midst of this fold there is a transparent point, which at first sight appears like a hole; the edges of this point are tinged with yellow in adults, but not in the new-born infant. This peculiarity of the human eye, which had escaped the observation of all anatomists before SŒMMERING, is found in no other animal, except in monkeys. We have observed it in the *Cynocephalus*, in the *White-nosed Guenon*, &c. In the first, the transparent part is considerably larger than in man, and of an oval form: there is sometimes a yellow spot at its side.

"The Maki, which of all Mammalia approaches nearest the monkeys, has only a slight fold, without any spot or transparent point. The other species have nothing similar."

These facts, and others, relative to the pathology of this *foramen* in the human retina, were pointed out by many distinguished comparative anatomists. The yellow spot or tinge, more or less surrounding the foramen, is said to be wanting when vision has been obstructed; and the plait is small and wrinkled. In monkeys, the yellow spot is occasionally absent. The important fact, that the appearances are limited to the eyes of man and a few quadrumanous animals, has been much dwelt on by physiologists, whilst the existence of a *foramen*, or transparent point of the membrane of the retina, situated in the actual line of vision, has been deemed by most absolutely inexplicable.

In a work just published by De Blainville, a distinct and direct allusion is made to a theory, partially supported by nature, but which, in the present instance, is not applicable.

It is there remarked *, that "the differences which the Mammalia present, in the point of view we at present consider, are always susceptible of being divided into two categories; the one sort, pretty nearly inexplicable, is connected with what we have called the classical degradation, and with the degree of organisation to which the species belongs; the others are evidently in relation with the medium in which the animal must seek its food, or with the time of day during which it is so employed,—or, finally, perhaps with the nature and kind of its food."

"I arrange (he continues) in the first category, the sort of yellow spot, with a small depression, more or less oval, translucid in the middle, around which the retina is somewhat folded, which may be remarked in this membrane at some distance externally from the entrance of the optic nerve, in the axis itself of the globe of the eye. It is found only in the human species, and in the real apes of the Old and New Continent."

Unfortunately for the ingenious theory just quoted, the transparent point of the retina or foramen, and the fold of the membrane, exist in a class of animals differing widely from man, and from the apes of the Old and New Continent: the class I allude to is Reptiles. I shall here briefly describe the appearances, and the particular species in which I have detected so singular an appearance.

Professor Jameson having requested me to re-examine with great care my dissections of the class of *Reptiles*, and

* Principes d'Anatom. Compar. p. 375.

having most kindly and liberally furnished me with the necessary specimens from the Museum, and, at the same time, pointed out the works of the comparative anatomists of Germany, with whose labours he is intimately acquainted, I deemed it a favourable opportunity for completing my inquiry into the organ of vision, and of adding to those observations which I had the honour lately to submit to the Royal Society of Edinburgh. It is not my intention here to enter into any details relative to the eye of Reptiles generally, but simply to describe the transparent point, or *foramen centrale*, and fold of the retina, which I have found to be comparatively much more developed in these animals than in man himself.

The animals in which these appearances were discovered by me were all of the Lizard tribe *, and the first in which I remarked the presence of the transparent point, was the *Lacerta supereiliosa* of naturalists. The notes taken during the dissection are as follow.

1*mo*. The eye-ball comparatively large, resembling in external form that of the bird; the sclerotic horny and strong anteriorly, of a bluish colour, soft and elastic posteriorly. The retina very thick, somewhat firm and opaque. Where the optic nerve enters the interior of the eye-ball, there is a distinct marsupium, or black circular body, proceeding forwards apparently through the centre of the vitreous humour: this membrane, no doubt, incloses the bloodvessels distributed to the lens, hyaloid membrane, &c. Anteriorly, somewhat superiorly and towards the mesial line or plane, we perceive, on looking on the surface of the retina which regards the vitreous humour, a comparatively large transparent, nearly circular spot, through

* I ought to remark, that the most of these specimens had been preserved for a great length of time in spirits.

which may be distinguished the dark-coloured *choroid*. Close to this is generally placed a fold or reduplication of the retina, which is in general remarkably distinct. This fold (or folds, for, occasionally, there are more than one), either proceeds from the transparent point towards the insertion of the optic nerve, or close to it. Sometimes the fold seems, as it were, to lie over the transparent point, and partly to conceal it from view; or the point is formed in the edge of the fold itself, as in apes; but, in general, the fold runs directly from the insertion of the optic nerve upwards and inwards, passing very close to the edge of the *foramen centrale*. It will readily be imagined, that the farther dissection of this part of the retina was attended with much difficulty, on account of the smallness of the eye-ball. On the inner surface of the retina, and covering even the transparent point, is an excessively delicate vascular membrane, apparently supporting the branches of the central artery of the retina. When we remove the retina from the choroid, the former of these membranes, in some specimens, divides readily into two very distinct layers. The first, or that nearest the vitreous humour, is of an opaque-white, pulpy and thick; the second, or that situated next the choroid, is thin, of a slight bluish cast internally, pale brown externally, and cannot be detached *en masse* from the choroid, though sufficiently large flakes may be forced off with the edge of the knife. Near the Point of Sœmmering inwards, towards the insertion of the optic nerve, and around the *foramen centrale*, these two membranes are strongly connected with each other, and cannot be separated. When the whole of the membrane which we generally call retina is removed from the choroid, and drawn gently towards the optic nerve, there is evidently a circular aperture in the retina, constituting the *foramen centrale*, and

the choroid has at this point a slight projection inwards *.

I have stated that the fold of the retina is sometimes totally unconnected with the *foramen centrale*, but may be found occasionally proceeding from the point of insertion of the optic nerve outwards. When there are more than one, they resemble radii drawn from the centre of a circle towards its circumference. Sometimes a large deep fold proceeds from the optic nerve towards the edge of the transparent point, and from it outwards in a straight uninterrupted line. It would seem, therefore, that the formation of these folds is accidental, in so far as regards their presence, or absence, or situation; but that they do not depend for their production, as has been supposed, on any mechanical disturbance of the internal parts of the eye-ball after death.

Two specimens of the *Lacerta superciliosa* were examined, and one of the variety called *Scutata:* in all these the above anatomical appearances were remarkably distinct; and being comparatively larger than in man, did not require, in order to be perfectly seen, the aid of magnifying glasses.

Three specimens of a small lizard, agreeing in description with the *Lacerta Calotes* of naturalists, were examined. In these the eye-ball is somewhat less than in the *superciliosa;* but in all other points, as the distribution of the retina, the existence of the transparent point, deep and extensive folds of the retina, &c., the animals entirely agree.

In a very small specimen of the *Lacerta striata*, I observed the retina folded in a remarkable manner, and, by the aid of a strong glass, I thought I perceived a small

* There is in my possession a very beautiful preparation illustrative of this long disputed point.

transparent point situated as usual, and close to the edge of this duplication of the retina: and, in a small variegated lizard, with lobated feet, I observed the *foramen* or *point* very distinctly *.

In the lizard called by naturalists the Gecko, the marsupium is very small, and the *foramen centrale*, or transparent point, is wanting. Neither could I perceive it in the lizard called by naturalists *Lanins* (the *Lacerta Mabuya*); in them also the marsupium is very small, though distinct. We thus discover that the foramen of Sœmmering is found in a particular family of lizards, whilst it is wanting in others. Analogy would lead us to suspect its presence in the Chameleon, whose eye I have not yet had an opportunity of examining. It remains also to be discovered, whether the same anatomical distribution extends to the higher orders of lizards, as the Iguana, Tupinambis, and Crocodile †.

There remains only a single additional fact which I wish to communicate in this notice; it regards the supposed existence of vessels passing between the foramen of Sœmmering and the vitreous humour. With the view of determining this point, I opened the eye-ball *in situ* with the greatest care, and watched the removal of the humours from the retina; but however frequent the examination, I could never discover the smallest appearance of blood-vessels, lymphatics, or membranes, connecting at this point the retina and vitreous humour.

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* These lizards belong more strictly to the class of true or proper Lizards than either the *Superciliosa* or *Calotes*.

† I have since ascertained that neither marsupium nor *foramen centrale* are present in the Crocodile.

Edinburgh,
June 20. 1823.

II.—*Observations on the Lesser Guillemot and Black-billed Auk, the Colymbus Minor and the Alca Pica of Linnæus.*

By Laurence Edmondston, Esq.
Corresponding Member of the Wernerian Natural History Society.

(*Read 26th April* 1823.)

THE practice of conferring specific distinctions on animals essentially identical, has been, among systematic writers, more general than that of confounding those which are distinct; and in the progress of extended and accurate observation, it becomes perhaps equally advantageous to retrench fictitious species as to discover new ones.

The system of Linnæus, long maintaining an influence so powerful and extended, and fixing on certain artificial, and often arbitrarily assumed, external characters, as legitimate grounds of specific difference, contributed much to that excessive and fallacious multiplication of species of which we find so many instances in zoology. This was indeed a very natural result of that artificial system, which it was perhaps expedient and necessary for Linnæus to

select in the infancy of that science which his genius and industry so surprisingly advanced. Hence it happened that, in zoology, as in botany, the attention was perpetually in search of some one or two characters which, it was presumed, must necessarily distinguish each individual species. In birds, for instance, the colour of the plumage, especially of certain parts, as the tips of the primary quill-feathers, the tints of the iris, of the bill, feet, or peculiarity of habits, without noting the causes of diversity, were each separately held to be immutable specific distinctions.

It seemed to be forgotten, that it is seldom by one difference, but an assemblage of many, that nature marks specific distinctions; and had this been more frequently kept in view, we should have had less now to unlearn in some of the most interesting and apparently simple walks of natural history.

Buffon and his followers adopted an opposite, but more erroneous, course,—preferring vivacity and eloquence of description to conciseness and accuracy of systematic arrangement; and their labours are conspicuous chiefly for the elegance of their style.

The modern French school seems peculiarly to have distinguished itself by the variety of its divisions in the higher departments of classification; and a tendency to excessive refinement of nomenclature has perhaps been too frequent in their writings. Authors on classification have outstripped the progress of observers on species, and, amidst the multiplicity of their subdivisions, seem sometimes to have lost sight of one of their chief objects—the discovery and accurate delineation of species. But it is still to this school, next to that of Linnæus, to which zoology owes most of its interest and accuracy. The illustrious Cuvier has ennobled and exalted it to the rank in the scale of knowledge

which it has a right to occupy, and has unfolded its intimate connection with physiology and geology.

Discussions that have for their object the enlargement and more accurate knowledge of such a science, will always be candidly appreciated by a mind truly philosophical, though they may be destitute of the parade of diagrams, or the mazy ingenuities of political arithmetic. The period is long past when flippant sneers at the patient and necessarily minute labours of the naturalist were received as wit; it is now practically known that it is infinitely easier to ridicule than to reason; and that nothing is so contemptible as contempt from ignorance.

Another frequent source of error in specific distinctions may obviously be found in the practice of determining species merely from the examination of stuffed specimens, with little of that previous and necessary preparation, alone to be derived from the frequent and continued habit of observing animals in their living state, and ranging over their native haunts untrammelled by persecution or domestication. It could hardly be expected that museums alone could confer that *visus eruditus*, so necessary and useful in discriminating animals from each other, as it is in other subjects of comparison. There is a physiognomy that marks different species, as individuals of the same species are often easily distinguished, when we have frequent opportunities of observing them, which, although difficult to be described, is yet strongly felt by the experienced, and which often affords the hint for the detection of more tangible grounds of difference. What is it chiefly but this that renders the rude fisherman or woodman often more accurate in specifically distinguishing his native animals than the systematic naturalist,—or which enables the shepherd to know each individual of his flock of many hundreds?—differences in their aspect, which by others are inappreci-

able, are to him prompt and certain grounds of distinction. With what superior facilities to the northern naturalist would a native of the tropical regions enter on the description of his indigenous animals, that, for example, of the numerous species of birds of paradise, of humming-birds, parrots, monkeys, insects? and the tropical zoologist would find a difficulty of a similar kind, though not so extensive, in describing our northern animals.

To these causes are mainly to be ascribed much of the difficulty and error which we meet with in the study of zoology, as well as to the immense diversity of its objects; and much requires yet to be supplied, even in one of its most interesting and apparently most accessible branches, Ornithology.

Our knowledge of many species of European birds is still sufficiently defective; and from their being more frequently presented to our observation, and naturally furnishing criterions of distinction for others, they especially require to be clearly known.

In the notices of a few of those species that have occasionally been submitted to the attention of the Society, I have felt the influence of the preceding views, and have uniformly communicated only the result of my own observations, in the first instance.

When I found opinions of others on the same subjects, whether favourable or opposed to my own, I have freely examined them; but have not allowed myself to enter into discussions in regard to all the speculations that have been advanced, as these add but little to the value of ornithological investigation.

I shall have the honour of continuing this series of observations which I have commenced on several northern animals, regarding which obscure notions may still be entertained; and those to which I shall confine my attention

at present, and which aptly illustrate the preceding views, are, the two supposed species of Lesser Guillemot and Black-billed Auk, the Colymbus Minor and Alca Pica of LINNÆUS.

It cannot but appear surprising that their claims to specific distinction should not long since have been disposed of, and that there should be still naturalists who remain in doubt, or assert their distinction. I was induced to apply particular attention in endeavouring to settle this question, not more from its involving the knowledge of the identity of two species, and opposing established opinions regarding them, than from my desire not hastily to deny the accuracy of the views of MONTAGU, an ornithologist of whose acuteness and industry I entertain so high an estimate; and I feel quite satisfied, that had his opportunities of observation in this instance been more varied and continued, his candour would have induced him to have relinquished opinions which he has so elaborately and ingeniously supported.

Last summer, while in Zetland, I possessed opportunities the most select for determining the weight to be attached to his opinions on these two species, and clearly convinced myself that what I had always believed regarding them was literally correct. I had also collected a regular uninterrupted series of specimens of the Razor-Bill and Foolish Guillemot, from the egg to the full-grown birds, erroneously described as distinct species. And the loss of the parcel, containing also other specimens of interest, from the shipwreck of the vessel by which they were transmitted to this city for the inspection of the Society, I much regret, as it not only deprives me of many conclusive and satisfactory illustrations, but precludes that brevity which I am anxious to observe in discussions of this description.

The opinion which I hold regarding the Colymbus Minor and Alca Pica is, that they are merely the young, or the old in winter-plumage, of the two species Colymbus Troile and Alca Torda, the Foolish Guillemot and Razor-Bill. Many ornithologists have maintained that they are separate species, but as MONTAGU has included all that has been advanced for this opinion, I shall examine chiefly what he has stated on this subject.

It has been insisted on as a very strong circumstance in favour of the distinction of the two disputed species, that they are uniformly inferior in size and length of bill to those which are maintained to be their respective species in a state of maturity; but even if this difference of size were admitted, it could not be of any weight in specific distinction:—it is very inconsiderable, and very varying, and can be observed only for a limited time; for, according to MONTAGU, we can have an opportunity of seeing these species of Lesser Guillemot and Black-billed Auk only during the winter months. Is it not very natural to anticipate that the young should not attain the full size of the parent birds for some time? Inferiority of size, therefore, should rather be a presumption against the opinion of their distinction. But, as far as my observations go, there is no uniform difference of size; they are fully as often to be met with equal in size as inferior; and even individuals of the C. Troile and A. Torda often materially differ in this respect. This irregularity may chiefly be attributed to inequality in their supplies of food, to which they must often be exposed in their earlier age, when the tendency to permanent size is impressed,—from the habit of prematurely committing themselves to a boisterous and capricious element, and, consequently, often being separated from the protection of the parent birds.

The bill is said to be longer in the Foolish Guillemot, and there is an indenture near the point in both mandibles, while, in the Lesser, there are only the rudiments of a slight indentation in the lower mandible. My experience proves that the bill of the Foolish Guillemot is shorter in the young, and gradually lengthens with age. This was the case with those I reared from a few days old till they were ready to fly, when they had acquired precisely the plumage of the Lesser Guillemot; but were still inferior even to it in size and length of bill. The less numerous indentures in the bills, which are regarded by MONTAGU as peculiarly supporting his opinion, seem to me to lead to an opposite one. It is well known (as he himself admits) that the Razor-Bill, so analogous to the Foolish Guillemot in its changes of plumage and habits, has in its young state neither the size of bill, nor the numerous indentations, which it has in the adult.

It is surprising that this analogy should not have excited his suspicion. The white line extending from the bill to the eye in the Razor-Bill, and from the eye down the neck in the Foolish Guillemot, are conceived to be distinctive. In many specimens I examined, during last summer, these marks were absent; and in many specimens of the other two birds I have found them well defined; and the Danish writer MOHR*, in his *Islandik Natur Historie*, expressly mentions this as no ground of distinction.

* In this author I find most of the opinions I entertained on northern sea-fowl fully confirmed. For instance, he distinctly states the Colymbus Immer to be the young of the Northern Diver; and mentions not only its capability, but vigour of flight,—a fact which, being so long unaccountably overlooked, gave rise to so many fanciful and ridiculous conjectures to account for its habits and incubation. It is singular that this book, which is one of the best topographical works in natural history, seems so little known. It was published at Copenhagen in the year 1786.

The sulcæ in the bill of the Alca Torda cannot be considered as peculiar, for MONTAGU mentions a specimen of Black-billed Auk shot in February, in which the bill was as much furrowed as in the Razor Bill; and FABRICIUS also says, that all the young Alcæ have the bill less sulcated and coloured than the adults; —"hinc character de "sulcis sumptus lubricus satis."

This I have myself repeatedly verified. It may be strikingly seen in what occurs in the Puffin: and indeed it seems surprising that *its* young should not also have been described as a distinct species, equally as the young Razor-Bill.

The black in the plumage of the Razor-Bill and Foolish Guillemot is less deep, and it extends over the whole head and neck; while, in the others, the throat and sides of the head are white, and the black parts of the plumage are of a deeper tint. This, which is stated as peculiar to the Lesser Guillemot and Black-billed Auk, is exactly the winter-plumage of the young of the others. The old ones also assume the same appearance, still retaining the slight difference of a fainter shade of black on the upper part of the body. The specimen of young Guillemot, caught by MONTAGU in June, exhibits distinctly the young of the *preceding* autumn, passing into the plumage of the adult; and the winter-plumage of the Razor-Bill, as stated by FABRICIUS, is the same as that of the Black-billed Auk. The Little Auk is admitted to change its plumage in winter, to become white on the throat and sides of the head,—while these parts are black in summer. This is exactly such a change as its congenerous bird the Razor-Bill is asserted to undergo.

If the Colymbus Troile and Alca Torda be distinct species from the others, and preserve their distinct appearance, how happens it that we never meet with them in winter?

Though it were granted that they migrate, yet a few ought occasionally to be seen during winter. The fact stated by MONTAGU, of a few Guillemots, in their usual plumage, being found in the end of January on the coast of England, is merely an instance of the old birds acquiring the summer-plumage sooner than the young ones; and, moreover, this is confessed by MONTAGU to be "a *single* instance:" besides, if it were necessary, it might still be reasonably supposed, without receiving his conclusion from this fact, that these individuals had assumed their summer plumage earlier than is the general habit of the species; and this is an irregularity not unfrequent in other birds, and which may often result from their not having paired the preceding year; their moulting, and winter change may thus have been less complete; for I have certainly remarked, that incubation renders the moulting succeeding it more severe, and the change of plumage more marked.

If the Colymbus Minor and Alca Pica be distinct species, Why are we not acquainted with their young?—or, Are the young always the same in appearance as the old? This is, however, contrary to the analogy of all water-fowl in our latitudes, and especially to that of the other species of this genera.

The Black-billed Auks are said to occur more numerously in Greenland than the Razor-Bill; but FABRICIUS, whom MONTAGU quotes for this fact, expressly says, he never saw the Razor-Bills there during summer,—it applies to the winter season; and the winter-plumage of the Razor-Bill, according to his description, is the same as that of the other. If then, as he admits, the sulcæ in the bill are no specific distinction,—how could he distinguish these two species from each other? It is sufficiently suspicious that he should never have seen the Razor-Bills in summer, when they are comparatively numerous in winter; but it

is easy to account for this, when he informs us, that the plumage of the Black-billed Auk in summer is just that of the Razor-Bill at the same season. It is farther remarkable, that while FABRICIUS gives minute details regarding the Razor-Bill in summer, a bird he declares he had never seen in Greenland during that season, he should say comparatively so little of the Pica at the same season, a species he mentions having seen at all periods of the year. He also states, that the Razor-Bill lays two eggs; and every other naturalist, ncluding MONTAGU himself, mentions only one; and my observation agrees with this. And he asserts that the weight of the Black-billed Auk is *superior* to that of the Razor-Bill; yet he maintains the same opinion as MONTAGU, of the distinction of these two species. These remarks shew the contradictions into which this author has been led; and that, though his authority is highly respectable in many other points of Arctic zoology, in this it must be received with limitation.

If they be the same species, MONTAGU conceives they must moult four times a-year, since four different states of plumage may be remarked; but this inference is not at all necessary. These different states are accounted for by supposing, what is the fact, and what is acknowledged to be so, that they moult partially twice a-year; and that the other changes of plumage are acquired, not by new feathers, but by the change of colour of the old ones. Of facts exemplifying this change of colour in the old feathers, every practical naturalist has ample opportunities of satisfying himself; and for farther information on this point, I have only to refer to a very useful and interesting work, "The "Philosophy of Zoology," by a most intelligent and zealous naturalist, Dr FLEMING, whose opinion respecting these disputed species I am happy to find is the same as my own.

MONTAGU refers the disappearance from the British coasts during winter of the Razor-Bills and Foolish Guillemots to migration; but this is a cause that has been much too generally applied to account for the apparent absence of many species in certain countries; it may be often accounted for by supposing them to change their plumage, or merely to disperse, when not induced by incubation to keep to certain haunts, and in numerous assemblages.

FABRICIUS says, that the Razor-Bills and Black-billed Auks breed in Greenland, and are found there during the winter; but MONTAGU states, that the Razor-Bills, not being so hardy as the others, migrate from the British coasts in winter, and their place is taken by the others. How, then, does it happen that the tribe of Razor-Bills in Greenland are so much superior in hardihood to their effeminate race on our coasts, and are able to brave the rigours of the frozen regions, when so many of the Black-billed Auks even are compelled to quit them? Or, if some migrate southward, how comes it to pass that they are never seen on the British coasts? The Black-billed Auks are very far from being so numerous in Zetland as in Scotland,—perhaps not much more frequent in that country than in England,—yet if such multitudes came from Arctic countries, we ought occasionally to observe them there on their passage southward, as happens with other birds, which visit it as a half-way station.

Not a single Lesser Guillemot or Black-billed Auk is seen on the coasts, even of Zetland, for six weeks after the alleged migration of the other species. This is decidedly opposed to all my observations. I have met with them from the period at which the Razor-Bills and Foolish Guillemots are first observed to quit the cliffs (in August), throughout the winter, till the middle of the ensuing spring. If they be not the same species, how shall we account

for this circumstance, that they are uniformly found in Zetland a month or six weeks before any other Arctic birds make their appearance? Many of them are also then in a state of moulting, and incapable of flying; others have their osseous system almost cartilaginous,—their sexual organs imperfect, proving them to be young birds, and therefore also equally incapable of flying. All this could not have happened if they had had so distant and stormy a migration to have effected.

There are no Lesser Guillemots or Black-billed Auks to be found in Zetland in summer. Those met with in winter are regarded by the fishermen as the same species as the others. Their habits are said to be different. It is mentioned that the Lesser Guillemots and Black-billed Auks are found in great numbers on the coast of Scotland during the winter, while very few are found on the coast of England; and in neither country a single individual of the other two species is to be found, though vast numbers breed in England. To migrate northward in winter is conceived to be unnatural and inconsistent, and, it is presumed equally so, to suppose the young birds to be different in their habits from the parent birds. If the old and young present the same plumage in winter, then there is no necessity for supposing that the former migrate; and the objection of distinction of habits does not exist: but, besides, difference of habits is not a specific mark in many instances; it of course constitutes an important feature in specific distinction; but then it is *permanent* difference, not that of season or age, or insulated from other circumstances. Many birds of the same species are very different both in plumage and habits in the young and adult state, and many species modify their habits according to locality.

The Black-backed Gull, for instance, feeds on fish and carrion alone in some countries; in others, he mimics the

Eagle, and treats himself to birds and young lambs! The Cormorant, in some situations, perches on trees, while, for the most part, he rests only on rocks by the water-side.

The Hooded Crow, in maritime situations, forgets his characteristic timidity for the water, and skims along its surface like a Gull in pursuit of small sea animals, though, as I have sometimes witnessed, he occasionally suffers from his aquatic excursions. I believe one of the most characteristic marks of distinction of species of birds is to be found in their modes of flight; it at least furnishes a good generic distinction. And to those who are in the practice of observing the habits of birds, this difference of flight is very striking: no one is more aware of this than the expert sportsman, for much of his success depends on this knowledge.

The reason of these birds accumulating in Scotland in winter, and not in England, is quite apparent; the deep bays and friths of the former afford them food and shelter, which the exposed coasts of the latter cannot confer. It cannot be mere climate; for there is surely not so great a difference between the winter temperatures of these countries, as in proportion to the greatly superior numbers that are found in Scotland at that period of the year. It is accordingly in the Frith of Forth and the Moray Frith in the east, and the corresponding lochs in the west, that they are chiefly found, while they are comparatively rare on the intermediate exposed coasts. The supposition, therefore, that they should migrate northward to a short distance in the winter, is not in "violation of the actual cause of the propensity to migrate."

The Foolish Guillemot and Razor-Bill produce each one young one in the year. The young, till about a week old, are covered by a dusky-grey down; and the first colour of the feathers is that of the parent-bird. Previous

to quitting the cliffs, about the middle of August, they have attained about one-half the size of the old ones: at this period the plumage is changed, the under part of the neck and sides of the head having become white. This is the state of plumage in which they have been described as distinct species, and they preserve it during the winter. In December they have attained the size of the adult birds. To assure myself of their changes, I kept several individuals tame till they were able to fly, and thus distinctly traced them. On the approach of spring, they may be seen passing into the summer-plumage of the mature birds. These also change in winter, turning white on the lower part of the neck and sides of the head; but, in the earlier part of this season, they may be distinguished from the young, by their greater size, and the less vivid black of the plumage. In the old Razor-Bill, also, the bill is larger, and more furrowed. In the adult Guillemot, the bill is considerably longer. As the season advances these distinctions become less apparent; but the old birds acquire their summer-plumage earlier in spring than the young.

There appears, therefore, no reason for separating the Colymbus Minor and Alca Pica from the Foolish Guillemot and Razor-Bill; and hence two species are expunged from the list. In the discussion which has led me to this result, I have been necessarily minute; but I have hardly been more so than the very ingenious and respectable ornithologist from whom principally I have differed. The opinion I have supported is not a new one, but has been held by many naturalists, who have, however, chiefly contented themselves with its mere statement, without satisfying their readers with an exposition of their reasons for it. This I conceived it to be useful to supply, especially as the advocate for the opposite opinion had displayed so much elaborate ingenuity in maintaining it. The discus-

sion may also not be useless, in illustrating some of those sources of error and precipitancy of observation, which have so much obstructed the advancement of zoology. If species so much in our way have been so long erroneously known, it is not surprising that others less numerous and accessible should be also so. The great influence, too, of MONTAGU, in questions of British Ornithology, required that the few errors into which he had been unconsciously led by partial observation should be fully understood.

The habits of the Razor-Bill and Guillemot are similar, and very interesting; they are gregarious, more or less, all the year round. They occupy the same kind of cliffs during the breeding-season, though the two species do not indiscriminately mingle on the same rock. They select long parallel ledges in the precipices about half-way from their summits, where they may be seen in large flocks, sitting close together, and ranged above each other in regular rows; their white breasts, black heads, and erect forms, giving them a peculiar and orderly appearance.

They live in the most cordial harmony with each other, and display uncommon affection for their young. These are taken to sea long before they seem capable of flying, and when their wings can be employed chiefly in assisting their motions under water. The fishermen assert, that the old birds carry them on their backs to the sea; but this seems unnecessary. I have seen some quit the rock for the first time; they were not one-third of the size of the adult birds; and all that the wings seemed able to effect, was a kind of balancing motion, to weaken their fall in the water. When they reached it, they immediately dived, and, although visiting it only for the first time, swam well, and kept long under it; and some even dexterously eluded, after the manner of their species, shots fired at them, by diving on the flash of the pan. The parent-birds were near,

and anxiously endeavouring to allure them from our reach. After the old ones have brought the young to sea, they almost immediately leave the land, and both young and old are then found in great numbers several miles off. The object of thus hurrying out to sea, seems to be to remove their young from their more numerous enemies, and to place themselves in comparative safety in commencing the process of moulting. This is very complete, or at least leaves them during part of its progress without the power of flight, the old feathers being generally cast before the new are sufficiently long for this purpose. The Velvet Ducks in North America are annually killed in great numbers during the moulting process, when they are incapable of flying; and the Auks and Guillemots would experience similar havoc, if instinct did not teach them to withdraw from the reach of their more formidable pursuers. After an absence of two or three weeks, they again approach the coast, and are found occasionally in parties of three or four individuals.

The young are easily tamed, but I think rather difficult to rear. They display an unaccountable restlessness towards evening, incessantly moving about, and uttering a plaintive, piping sound. They do not seem to be able to exist long in situations where they have not the opportunity of diving, and this, perhaps, is the reason of their going so early to sea. The fact, at all events, seems certain, however difficult it may be to assign a physiological reason for it.

The thorax is very much elongated, and capable of great distension. The circulating system is much developed; the heart and primary red vessels peculiarly capacious. The blood seems in greater quantity, and its colour is deeper than in land-birds,—a fact I have remarked in most diving animals. The tenaciousness of life is very remark-

able. Two old Guillemots were confined in a cage for a fortnight, in endeavouring to domesticate them: during the whole time they obstinately refused all food; and when I released them to their native element, they seemed little changed, but in weight. One was a little weaker than the other; and it was interesting to observe the care and tenderness with which it was regarded by its more vigorous companion: when it was unable to keep up with him, he would occasionally turn back, swimming round it, and apparently encouraging it by sounds and gestures to proceed beyond the reach of danger.

They are often observed to swim long after being shot through the heart: if the lungs, however, are wounded, they are unable to continue under water. The more speedy way of depriving them of sensation and life is by a sudden and violent concussion of the whole body.

It seems almost impossible to tame the old birds; indeed this is no unusual case, where birds naturally familiar in the wild state, or easy of domestication in the young, are incapable of it when in the old.

From their breeding, for the most part, in situations of tolerably easy access, so much devastation is annually committed by the fishermen among old birds, eggs, and young, that their number seems progressively diminishing; and it is to be regretted that the proprietors do not exert themselves to limit this abuse. It is not as it was formerly in Zetland, and still is in some remote islands, when sea-fowl constituted a regular and necessary article of subsistence. The fishermen never trust to them for this use, and the most experienced and adventurous climbers are often the most indigent; besides, it is only the inhabitants of a few districts, that, from their vicinity to the haunts of sea-fowl, can practise their annual depredations, and they are observed to be certainly not more substantial than their

neighbours. The practice encourages irregular, rapacious, and dangerous habits, for fatal accidents are not unfrequently occurring to the fowlers; and checking its excess, would be repelling no romantic notions of liberty and attachment to country, associated with the chace, in minds alive to the refined pleasure of sublime scenery; for it is not the love of the chace, but its supposed subserviency to their emolument or taste, that induces them to pursue it.

It has been observed, that, around grazing islands, and situations where sea-birds were formerly numerous, fish were also very abundant; and that the diminution of both keeps pace in some degree with each other, although fishing is not now more generally practised than before. Causes for this result it might not be difficult to assign. Besides, water-birds, by scattering migratory fish, as the herring, tend to render them more stationary and permanent in countries through which they might merely pass.

Many of these species, also, in defence of their nests, prevent the more powerful rapacious birds from approaching near them, and thus are indirectly the protectors of the flocks that pasture in their vicinity.

Proprietors seem not sufficiently aware of these advantages, or of the inexpressible interest and ornament which the feathered inhabitants throw over the rocky scene.

EDINBURGH,
March 24. 1823.

III.—*Observations on the Anatomy of the Duck-billed Animal of New South Wales, the* Ornithorynchus paradoxus *of Naturalists.*

By Robert Knox, M. D.
Member of the Wernerian Natural History Society, and of the Medico-Chirurgical Society of Edinburgh.

(*Read 17th May* 1823.)

Memoir I.

On the Organs of Sense, and on the Anatomy of the Poison-Gland and Spur.

It will not be expected that, after the numerous dissections of the Ornithorynchus, performed in England, Germany, and France, by the most distinguished living anatomists, any very remarkable facts should have escaped notice. I am anxious that this should be borne in mind, for there are many who, viewing the Ornithorynchus as an excessively rare animal, might suppose every fact brought forward to be new, and censure the want of details, which could be useful only in the description of an animal hitherto altogether unknown. Now, this is far from being the case with the subject of the present memoir; for, at least one specimen has been anatomized in Germany, by Professor Blumenbach; one in Prussia, by M. Rudolphi; several

in France by the very celebrated author of the *Leçons d'Anatomie comparée*, and by others; and about ten specimens, in the best state of preservation, in London.

Professor JAMESON, who did me the honour to entrust the dissection to me, encouraged me to proceed in carefully noting the details, because, though nothing novel should present itself, the investigation might still prove useful, by confirming the discoveries of others. We were also aware that the descriptions of the most celebrated anatomists were completely at variance with each other, and with those of naturalists, relative to the anatomy of some very important organs; and that, consequently, the physiology of these organs must remain doubtful and conjectural, until the cause of these differences should be satisfactorily explained. I have only farther to mention, that as it was necessary to respect the skeleton, which is intended for the Museum, I did not consider myself at liberty to attempt any very minute dissections of the nerves, organs of sense, ligaments of the joints, and soft parts situated in the bottom of the neck and upper part of the thorax, which were otherwise required to render the observations complete.

It is well known that the specimens of this very extraordinary animal first brought to Europe were considered by many as impositions. They reached England by vessels which had navigated the Indian seas, a circumstance in itself sufficient to rouse the suspicions of the scientific naturalist, aware of the monstrous impostures which the artful Chinese had so frequently practised on European adventurers; in short, the scientific felt inclined to class this rare production of nature with easternmermaids and other works of art; but these conjectures were immediately disproved by an appeal to anatomy.

As the animal became better known, attempts were made by naturalits to arrange it with the Mammalia, to which

grand division of the animal kingdom it evidently belonged; and, accordingly, in the Manuel of M. BLUMENBACH, we find it classed with the Beaver, Seal, Lamantin, &c. In the "*Regne Animal*," the Ornithorynchus is better arranged with the *Edentata*, and is placed last. Two species are mentioned, one with reddish, smooth and slender hair, the *Ornithorynchus paradoxus* of BLUMENBACH; the other characterised by dark-brown hair (*brun-noirâtre*), flattened and crisped *. M. CUVIER conjectures that these may be but a variety from age; but I have observed, that all the dried specimens preserved in the Museum belong to the first species,—whilst the two animals lately imported, and of which I dissected one, belong decidedly to the second. These different species may be distinguished, not merely by the colour and texture of the hair, but also by the shape of the tail, which, in the latter, altogether resembles that of the beaver, as well in external appearance as in internal structure.

The specimen dissected measured 16½ inches from the end of the upper bill to the extremity of the tail; from the edge of the cloaca to the extremity of the tail measured about four inches.

The Ornithorynchus and Echidna (an animal closely allied to the former) are oviparous †. As they have no mammæ, they are without the grand characteristic mark of the first class of animated beings. Already naturalists begin to think, that animals differing so remarkably from the Mammalia, cannot with propriety be arranged with them.

The skin being the part to which naturalists chiefly direct their attention, has been sufficiently well described.

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* Voyag. de PERON, I. pl. XXXIV. The drawings of the Ornithorynchus in PERON's Works are ill-executed, judging by the specimen now before me.

† HOME, Phil. Trans.

The palmated feet, and membrane extending beyond the toes of the anterior extremity; the remarkable peculiarity of the bill, resembling so closely that of the duck, and to which an almost incredible number of nerves are distributed by all the great divisions of the fifth pair of cerebral nerves; the peculiarity of the hair, which is of two sorts, one sort fine and jointed, found on most parts of the body, but chiefly on the sides and abdomen,—the other bristly, flat, and shaped like the head of a spear, and which is found chiefly on the back and tail; all these facts, I believe, have been already noticed. The beaver-like tail of the animal is covered with short hairs of the spear-pointed form; these more resemble bristles than hairs. The skin is thick and compact; and a powerful *panniculus carnosus* extends over the whole body, the feet, tail, and bill, being of course excepted. Some very distinct muscular slips arise from the *panniculus carnosus;* the most remarkable are, 1*st*, The *platysma myoides*, or *dermo-clavicular*, arising near the angle of the jaw, and proceeding downwards to be inserted into the aponeurosis covering the horizontal branch of the clavicle; 2*d*, The *dermo-humeral*, a strong muscular slip, arising from the panniculus carnosus, lying over the lower ribs, and following the course of the pectoral muscles, is inserted into the os humeri, tendinous in common with the above muscles; 3*d*, The *dermo-tibial*, a strong slip, which joins the caudo-tibial, and has a common insertion with it; *lastly*, Two very strong muscular expansions, arising from the skin of the back, and loins, and converging like the radii of a circle towards its centre, are inserted into the root and sides of the tail, and into the transverse processes of several caudal vertebræ: these are elevators of the tail, and may be called dermo-caudal. The action of the others does not require any particular notice. These are the chief pecularities of the *panniculus*

carnosus in the Ornithorynchus paradoxus: under the skin of the tail it degenerates mostly into a cellular tissue, in which is deposited a dark-yellow fatty matter. We may readily imagine the great powers possessed by this, the most extensive muscle of the body, over the viscera contained within it; and how, being only a little increased in the Echidna, this latter should thereby be enabled to roll itself up into the form of a ball, after the manner of the common hedge-hog.

The skin and subcutaneous cellular tissue abounded so much with oil, as to render this part of the dissection unpleasant; the cellular tissue betwixt the panniculus carnosus and subjacent muscles was coarse, and in many places assumed the form of semitendinous fasciæ. The skin extending beyond the toes of the anterior extremity contains within its substance five narrow longitudinal horny processes, resembling that which is found within the integuments of the upper mandible; the two innermost toes of the hind feet are likewise characterized by a process of the skin extending beyond the nails. I shall consider the bill of the Ornithorynchus as the organ of touch, by means of which the animal searches for its food; the supply of nerves is such as to render it the most perfect instrument of the kind with which we are acquainted. The length of the upper mandible, including the flap, is three inches nearly; that of the lower bill, and flap, only two.

The organs of taste and smell will not detain us long: the latter organ, indeed, could not be properly examined, as I was not at liberty to injure the bones of the face; it is probably not very energetic. The nostrils open anteriorly near the point of the upper mandible; the anatomy of the posterior nares is regular, as in the Mammalia. The tongue has already been sufficiently well described by authors; it is covered with a thick cuticle, and cannot be considered

as possessing much sensibility; it seemed to me that the gustatory branch of the fifth was comparatively very small, but the hypoglossal nerves were large, and proportioned to the development of the strong muscles connected with, or entering into, the composition of the tongue. It is sufficiently curious, that the muscular apparatus supplying the tongue of the Ornithorynchus should much resemble that with which animals having a highly extensile tongue are furnished; yet, in the former, the lower surface of the tongue is so secured as to render extensive motions of this organ impossible. The tongue is fleshy and thick: at about $\frac{8}{10}$ths of an inch from its base, or $1\frac{8}{10}$ths of an inch from its point, are inserted the lingual teeth, which, like the other teeth of the animal, are entirely cuticular, and may be removed by maceration along with the cuticle. I shall return to this subject when speaking of the organs subservient to digestion. The palate is marked by several transverse folds: deep notched indentations run along the sides of the lower bill, from its angle nearly to the point; those of the upper bill are found only near the angle of the mouth. These reduplications of the membrane of the bill might be supposed to increase the sentient surface; but it seemed to me that the nerves did not proceed to them in such abundance as to the anterior portions of the bill. I should consider, then, these folds as intended merely to allow the mandibles to close very accurately, and thus to prevent the escape of those smaller insects on which probably the animal feeds.

Though the actual organ of hearing did not come under my observation, still there presented themselves several appearances relative to those appendages, placed between it and the external air, which merit the attention of the Society. There is no external ear, or rather there is no ear externally; for although there be no cartilaginous projec-

tion exterior to the integuments, yet a tolerably perfect concha exists immediately beneath them. The longitudinal aperture by which the ear opens on the integuments is situated immediately behind the eye, and not far from the posterior or floating edge of the flap of the bill. The hairs are disposed around this aperture, as the feathers around the ear in birds. There is nothing peculiar in the aperture itself as to muscles, &c., but it opens immediately into a considerable cavity, formed by a cartilaginous plate, disposed after the manner of the concha of the Mammalia, and which we must consider as the true external ear of the animal, though it be not external to the integuments. The cartilaginous plate is fixed, on the one hand, to the long tube, connecting it with the cavity of the tympanum, and, on the other, in a very loose manner, to the superjacent integuments. Distinct muscles are attached to it, as in the Mammalia, which have the concha situated externally. These arise from the *panniculus carnosus*, and are inserted into the concha: there can be little doubt, that, by their action, and the loose attachment of the cartilage of the ear to the integuments, considerable motions are performed by it,—the object of which must be to increase the general cavity formed by the concha, and cartilaginous tube of the ear, and in some measure to increase the size of the external aperture. Nearly one half of the external opening of the ear is formed by the edge of the cartilaginous tube; the common integuments form the remaining half, because the cartilage properly called Concha is thrown back under the integuments, having an extensive margin attached slightly by cellular tissue to the integuments, completing, in this way, the circle of the meatus externus. We thus see that there is a certain degree of inaccuracy in stating that the Ornithorynchus has no external ear; and that it should be said that it has no ear externally, since a tolerably

perfect external ear exists immediately beneath the integuments. It is extremely probable that a similar distribution of these parts may exist in some other animals described as being without external ears.

We may now proceed from without inwards towards the internal ear, and briefly sum up the anatomy of the whole, as far as a respect for the skeleton permitted me to investigate. There is, first, the external opening, which had been mistaken for the simple termination of the cartilaginous tube of the ear, but which we have demonstrated to be the opening of the concha, that part of the cartilage which, in other animals, is in part detached from the head to form a true external ear, being in this animal concealed by the integuments, but in such a way as not to impede its functions. I need hardly mention, that the concha was situated at the side of the opening farthest removed from the cranium. From the cartilage of the concha arises a remarkably long cartilaginous tube, proceeding from the upper part of the head, close to the eyes, over the lower jaw, as far as the base of the cranium; it measures in length $1\frac{6}{10}$ths of an inch, and nearly $\frac{4}{10}$ths in breadth, when opened. The texture of the middle tunic is not quite cartilaginous; it terminates at the root of the styloid process, and opens wide into the cavity of the tympanum. Near its termination in the tympanic cavity, a few projecting points, on its inner surface, mark the probable existence of small cartilaginous bodies. The Eustachian tube is entirely cartilaginous, and is not inclosed in any osseous case; this is owing to a deficiency of a great part of the osseous circle constituting the frame of the *membrana tympani*. Now, in consequence of this deficiency, the anatomy of these parts is somewhat peculiar; for, in addition to the Eustachian tube being simply cartilaginous, and not inclosed in any osseous case, (which, so far as I know, is peculiar to this animal), the

ossicula of the ear are much exposed, and the tympanic cavity has a great portion of its parietes composed of soft parts, or, in other words, is placed in a great measure external to the cranium. The anterior part of the malleus is strongly attached to the extremities of the pterygoid processes of the sphenoid bone. The stapes is composed of a single stalk and circular plate, by which it is inserted into the vestibular foramen of the internal ear, the foramen being itself also circular. The form of the stapes appeared to me to be that in which the ear differed most from that of the Mammalia, and even approached reptiles and birds; and had nature preserved the same form of stapes throughout the whole class of Mammalia, we might have noticed the stapes in the Ornithorynchus as a wonderful peculiarity. But this is not the case, for, in the Cetacea, the stapes differs from all other mammiferous animals; it does not indeed resemble that of the Ornithorynchus; but it is sufficient for our present purpose, that it differs essentially from that type which nature has so extensively observed. "Instead of the two branches," observes CUVIER, "the Cetacea have a solid body, compressed conically, and perforated by only a very small foramen." In the Ornithorynchus this perforation is wanting, (though it be present in some birds, as in the Owl); and the slender stalk and circular plate of the stapes bear the closest resemblance to the analogous ossiculum in birds and reptiles. Between the external ossiculum, or that connected with the membrana tympani, and which bears a close resemblance to the malleus in many of the Mammalia, and the stapes, there exists an irregular triangular-shaped bone, evidently analogous to the incus. It is true, that this bone may, in the Ornithorynchus, be merely a process of the malleus; but I am by no means of this opinion, for the following reasons: 1*st*, It is most readily detached from the malleus; 2*dly*, It has a consider-

able resemblance to the incus of the Mammalia, and has precisely the same situation; *lastly*, The vertical direction in which it is placed, shows that it cannot be a process of the malleus. In thus reducing the ossicula of the ear to an analogy with those of the Mammalia, I am not unwilling to admit, that there are certain points of resemblance with those of reptiles and birds, more particularly in the semi-cartilaginous state of the bones themselves, in the exposed situation of the cavity of the tympanum, in the very peculiar form of the stapes; but it must be evident, I think, to all, that certain of these deviations from the usual structure arise out of the deficiency in the osseous parietes of the tympanic cavity, and consequent attachment of the small bones of the ear, and the membrana tympani itself, to a portion of the pterygoid processes. On the other hand, the internal aspect of the cavity of the tympanum appears quite regular; the vestibular foramen, that which in Man, by a faulty nomenclature, is called oval, is in the Ornithorynchus perfectly circular. An attempt is made, by a projection of the bones, to divide the tympanum into two cavities, in one of which is situated the *ossicula auditus*, and the vestibular opening. By the wide opening into the other cavity passes the facial nerve, which escapes from the cavity by a hole close to the cochlear opening of the internal ear; this latter is much larger than the vestibular. The principal branch arising from the superior cervical ganglion passes along the roof of the tympanum, and internally with regard to the stapes, on its way to join the fifth pair of cerebral nerves.

It will be readily understood that the cavity of the tympanum, which is inclosed partly by osseous, and partly by cartilaginous parietes, is considerable. Its anterior portion may be divided into two principal cavities, viz. that which contains the ossicula and vestibular foramen, and that

which extends upwards under a portion of the temporal bone, forming the glenoid cavity, and consequently extending towards the zygomatic arch. The posterior cavity, whose parietes are in like manner partly osseous and partly cartilaginous, contains the cochlear opening, and a part of the facial nerve in its passage outwards. A strong osseous plate, proceeding from the temporal bone to the base of the styloid process, is that which chiefly divides the anterior and posterior cavities from each other; but as the parietes of this second cavity of the tympanum are cartilaginous on one aspect, viz. the lower, the foramen by which the facial nerve escapes from the cranium is not completely osseous, but has about a third of its circle composed of cartilage. I shall conclude this sketch of the organ of hearing of the Ornithorynchus, by observing, that in no part of the anatomy of this animal have I found a greater deviation from the strictly mammiferous structure, as in the formation of the tympanic cavity, and in the small bones contained within it.

The position of the eyes in the upper and anterior part of the head, close to the edge of the flap, has been already noticed. The eye-balls are small, and placed deep in the orbits; they seemed to me quite regular, both as to internal structure, and to the muscular and nervous parts situated externally to the eye-ball. I could not perceive very distinctly any lachrymal gland, though anteriorly there is a small duct, which would seem to lead into the cavity of the nose, and, if real, may be considered as analogous to the lachrymal duct in the Mammalia. The convexity of the cornea belonged to a sphere not much smaller than the sclerotic; the lens is flat and soft; the orbit incomplete. Owing to the long immersion in spirits the internal structure of the eye-ball could not be distinctly made out, and

it would be tedious to describe its external muscles, which, so far as I could judge, did not differ greatly from those of the Mammalia *.

2. *On the Poison-Gland and Spur.*

It seldom happens that Nature leaves animals unprovided with means of defence against their enemies, and she has furnished the Ornithorynchus Paradoxus with one of the most extraordinary which probably exists. The comparative anatomists, as well of the Continent as of England, who first examined this animal, viewed the spurs as connected with the organs of generation: they were evidently peculiar to the male; and it was conjectured by Sir E. Home, and by the celebrated Cuvier, that they were merely accessory organs, and were accordingly classed with the organs of prehension. They are thus described in the *Anatome Comparée:* "L'ergot de l'Ornithorinque et de l'Echidné est composé de deux osselets ou de deux phalanges, dont l'une tres court, applatie, s'articuli sur une facette de l'astragale, située du cote interne et inferieur de cet os, et l'autre orgueale plus longe, de figure conique, sert de moule à la corne qui forme l'ergot. Cette corne est pointue, assez longue, fixée du coté interne de l'articulation du pied, ayant sa pointe dirigée en dedans."—Tom. v. p. 116.

A similar opinion was formed of the use of these spurs by most French and German anatomists. Some years after, a brief notice found its way to this country of severe cases of poisoning having followed a wound made by the spur of the Ornithorynchus. In consequence of this notice, the attention of anatomists was roused, and a specimen examined by Dr De Blainville, and one by Professor

* I thought I noticed a third eye-lid, though very small.

RUDOLPHI, with a view to discover the poison apparatus, if any existed. The known excellency of these distinguished naturalists, as comparative anatomists, induces me to think that the specimens examined by them must have been extremely mutilated, for their descriptions bear no resemblance to the true anatomy of the poison-gland and spur.

On the heel of each of the hind feet there appears externally a spur, much resembling that found in the common dunghill-cock. It is strong, semitransparent, and pointed; and there is evidently an aperture at the point, or rather on its convex surface, and sloped, as if a small piece had been cut out of it, without shortening the spur. Through this, a delicate black body, like a bristle, projects; it seems of a horny consistence; though a strong magnifying glass was used, it did not appear to be hollow. On removing the integuments carefully, the spur is found to rest by its base on a flat bone, placed longitudinally over the tarsal bones, and situated between the lower extremity of the tibia (to which it is attached), and the tarsal bone corresponding to the inner toe. Its principal connection, however, is principally with the astragalus. In this way two joints are formed, viz. one between the bone on which the spur rests and the other bones of the tarsus, and the other between the spur itself and the bone. The motion in both these joints is inwards towards the tail, and this is the direction which the spur assumes, and the only one in which it can possibly wound. If a longitudinal section be made of the spur, it will be found to contain a comparatively large membranous canal, gradually increasing as we proceed towards the base; this membranous tube is contained in the centre of the spur, which immediately around it has a whiter appearance than the more external portions, but has no resemblance to bone, as some estimable authors have stated: it is merely a litte firmer than the other parts

of the horn. As the membranous duct approaches the base of the spur, it becomes very strong, as if semicartilaginous tunics were superadded to it; just as it quits the spur to enter the sole of the foot, the duct makes a sudden turn, and is much contracted; it next expands a little, and at this point its parietes are so thick as to give it the appearance of a bulb or gland, an appearance which, together with the deep situation of the sac in the hollow of the foot, led M. De Blainville to consider it as the poison-gland itself, and which evidently has been the cause of the very singular errors commited relative to the anatomy of the spur. When this bulb is laid open, it is found to be merely a continuation of the mucous canal, which has at this point become greatly strengthened in its parietes, and assumed an almost muscular appearance. In the hollow of the foot the duct opens by a sudden turn into a comparatively large sac, surrounded and inclosed by strong ligamentous and tendinous parts, connected with the small bones of the foot. From this sac or bag, which in either foot contained a good deal of a brownish, mucous matter, arises the great duct leading to the poison-gland. We may now trace this duct either from the sac towards the gland, or *vice versa*. If the first plan be adopted, we perceive that the duct enters the central sac by a small round orifice, and next makes a very sudden turn to reach the superficial part of the foot, and is soon found almost immediately under the integuments. From this point it proceeds towards the gland, gradually decreasing in strength of parietes, but increasing in diameter until it terminates, or rather commences in the poison-gland itself, situated over and somewhat above the hip-joint and loins. Throughout its course the duct lies imbedded in loose cellular membrane, and beneath the caudo-tibial muscle, which must be removed, in order to

have a perfect view of the duct*. It is rather difficult to state the precise length of the duct from its origin in the poison-gland to its passage into the small sac situated in the hollow of the foot; for about $1\frac{8}{10}$ths of an inch its parietes are comparatively thin, and its diameter sufficient to admit a common blowpipe. The remainder of the duct, and the sudden turn it makes to pass down into the centre of the foot and to reach the sac, have been already described.

The poison-gland itself is about an inch in length, and $\frac{5}{10}$ths of an inch in breadth. It is a conglomerate gland, that is, made up of smaller ones, imbedded in a tissue of a different appearance, and which is probably cellular. It lies longitudinally with respect to the spine, immediately above the hip-joint, and close to the os innominatum of the corresponding side. It advances but little towards the loins; it covers many of the muscles which rotate the thigh, and may readily be found by merely removing the integuments, panniculus carnosus, and a small quantity of loose cellular membrane lying over the os innominatum and hip-joint.

The functions of these parts may now be very readily understood. The poisonous fluid secreted by the gland is conveyed by the long duct into the sac situated deep in the hollow of the foot close to the heel. From this it is projected into the membranous canal contained in the centre of the spur, and which, by an almost inexplicable error, has hitherto been mistaken for a bone. Along this it will easily flow into the wound inflicted by the spur, passing through

* The whole anatomy of the Poison Gland and Duct, has been beautifully depicted by the artist I employed, Mr R. Macinnes; and the circumstance, that none of the artists employed had the least knowledge of the anatomy of the parts, will no doubt be deemed of considerable importance by many.

PLATE I. *Wern. Mem. Vol. V. page 41.*

Linnæus Sculpt.

the small perforation existing, as well in the termination of the membranous canal, as in the spur itself. I am not prepared to say what may be the precise use of the small dark bristle-like body filling up, as it were, the extremity of the canal in the spur. It is not connected particularly with the membranous canal, but it must be evident that the poisonous fluid may find its way to the point of the spur by the sides of the horny substance alluded to. Fluids injected into the duct, near its commencement in the gland, pass into that contained within the spur, and even out of the extremity of the latter; and the pressure of a moderate column of quicksilver forced the metal to distil in excessively minute globules from the point of the spur.

The accompanying engraving (Plate I.) scarcely requires any explanation. On the upper and back part of the thigh and loins may be seen the large poison-gland and duct leading from it towards the bottom of the foot; a small steel-probe has been passed along the duct into the sac, in order to show the mode of its entrance into the latter; the bulb at the base of the spur, the membranous canal, and the spur itself, are all sufficiently distinct.

IV.—Tentamen Methodi Muscorum;

OR,

A New Arrangement of the Genera of Mosses, with Characters, and Observations on their Distribution, History, and Structure.

By R. K. Greville, Esq. F.R.S.E. M.W.S. &c.

AND

G. A. Walker Arnott, Esq. A.M. F.R.S.E. M.W.S.

(Continued from Vol. IV. p. 150.)

(*Read 26th April* 1823.)

Memoir II.

Gymnostomoideæ, *Gen.* (5—8.)

Char. Calyptra aut dimidiata aut mitræformis. Seta terminalis vel lateralis, longitudine et colore valde varians. Theca integra, sæpius æqualis, sed quandoque angulata. Operculum deciduum. Peristomium nullum.

Char. Calyptra either dimidiate or mitriform. Seta terminal or lateral, varying much in length and colour. Theca entire, generally equal, sometimes, however, angular. Operculum deciduous, and leaving beneath it no trace of a peristome.

Obs. To this tribe belong all Hedwig's *Gymnostomii* (excepting *Sphagnum*), and Palissot's section of "*Les Apogones urne tubulée*," with the exception of *Tetraphis*, which that author unfortunately supposed to be destitute of teeth; not having seen the true operculum, he mistook the peristome for that part,—"se divisant en quatre portions egales dentiformes permanentes."

Gen. V. Gymnostomum, *Hedw. Schreb.*

Fruct. *Calyptra* dimidiata, magna, vel thecæ appressa vel inflata, et tunc interdum 4-angulo-pyramidata, persistens et maturitate medio latere rumpens sic pseudo-mitræformis. *Seta* terminalis innovatione quandoque quasi lateralis, plerumque foliis perichætialibus multo longior, thecæ subconcolor, rigida, stricta aut flexuosa, in una tamen specie pallida, crassa, carnosa. *Apophysis* raro ulla? *Theca* integra subglobosa hemisphærica, turbinata, ovata, oblonga, aut cylindracea, etiamve angulata æqualis, aut quandoque sic medio subconstricta ut quasi apophysata, in speciebus diversis varians, sed in eadem plerumque at non semper constans; ore interdum contracto sed sæpius amplo, nudo, in quibusdam tamen annulo gaudente, brunneo-fuscescens, lævis, striata vel sulcata. *Operculum* deciduum, thecæ concolor, obliquum, rostratum, conicum aut mammillatum in quibusdam acutum, in aliis obtusum, semper integrum. *Peristomium* nullum. *Columella* ætate plerumque theca brevior, interdum longior et operculo adnatum, sæpius filiformis vel subclavata, stricta, rarius ampla, obconica vel potius infundibuliformis. *Sporulæ* valde variantes.

Char. Diff. *Calyptra dimidiata. Seta terminalis. Theca ore nudo.*

Fruct. *Calyptra* dimidiate, large, either closely embracing the theca, or inflated, and then sometimes quadrangular and pyramidal, persistent, and, in consequence of a lateral fissure, which then takes place midway between the base and the apex, becoming eventually pseudo-mitriform. *Seta* terminal, but sometimes apparently lateral from innovations; generally much longer than the perichætial leaves; similar in colour to the theca; rigid, straight, or flexuose; in one species, of a whitish colour, thick, and carnose. *Apophysis* rarely any? *Theca* entire, subglobose, hemispherical, turbinate, ovate, oblong or cylindrical, or even angular, equal, or sometimes so contracted in the middle as to appear furnished with an apophysis; varying in different species, but tolerably constant in the same; the orifice is sometimes contracted, but more frequently large, naked; in some instances furnished with an annulus, reddish-brown, smooth, striated or sulcated. *Operculum* deciduous, of the same colour as the theca, oblique, rostrate, conical or mammillose, acute or obtuse, always entire. *Peristomium* none. *Columella*, when mature, usually shorter than the theca, in some species, however, exserted, and even adnate with the operculum; mostly filiform or clavate, straight, rarely large, obconical, or rather infundibuliform. *Sporulæ* various.

Diff. Char. *Calyptra dimidiate. Seta terminal. Mouth of the theca naked.*

Veg. The stems of the *Gymnostoma* are extremely variable in length. In some species there is scarcely any at all; in others they are longer, but still simple; while in several they are much elongated, and repeatedly branched. The former, as might be expected, grow either in a solitary or tufted manner; the latter closely matted and interwoven together. The leaves present a reticulation curiously

varied; that of *G. Griffithianum* being perhaps the most remarkable, and resembling concave *foveæ* or pits, rather than regular cellules. *G. ovatum* is worthy of notice, from its leaves having a mass of minute round gemmæ on their nerve and centre. In regard to form, the leaves differ considerably; in *G. Griffithianum* they are nearly round; in *G. ovatum* ovate, with a hair-point; in *G. microstomum* and *Donianum* subulate; and if *Drepanophyllum* of RICHARD, HOOKER *, and SCHWÆGRICHEN †, be added to the genus, they are sometimes falcate. They are also either acute or obtuse, entire, dentate or serrate, usually slightly concave; but in *G. involutum*, they are remarkably involute; and in *G. julaceum* convolute; their arrangement on the stem is in every instance imbricated; the doubtful *Drepanophyllum* alone having them inserted bifariously. In none of the species are the cauline ones destitute of a nerve.

OBS. In this genus the two opposite extremities exhibit little in common; yet, with the exception of *Drepanophyllum*, the species may be said to form an uninterrupted series. Some bear a near affinity in general habit to other genera; as, for instance, *G. Griffithianum* to *Splachnum*, and *G. microstomum* to *Weissia*, &c.: such anomalies, however, must necessarily occur both in the embryonate and exembryonate tribes of vegetables. Of the above examples, however, *G. Griffithianum* is not in reality so closely allied to *Splachnum* as has been by some imagined; the reticulation of the leaves is of a very different nature, and the thick carnose seta is totally at variance with that genus.

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* Musci Exotici, tab. 145. † Sp. Musc. Supp. 2. tab. 125.

Drs HOOKER and TAYLOR have said (*Muscologia Britannica*), "A delicate horizontal annular membrane may be seen to arise within the mouth of the capsule of some species, when examined in a fresh state, as in *G. microstomum*, *G. fasciculare*, *G. truncatulum*, and, above all, in *G. Griffithianum*, in which, not unfrequently, this membrane is entire." And afterwards, "The membrane stretching across the mouth of the capsule is only to be seen in fresh specimens." Should this membrane in the latter moss be found hereafter to arise from the *stoma* (which, indeed, we very much doubt, but which, if it were the case, would bring this extraordinary plant under BROWN's character of *Hymenostomum*), and not to be a mere cover to the sporular sac, it would lead to the formation of a new genus. SCHWÆGRICHEN, indeed, in his Second Supplement to HEDWIG's Species Muscorum, has ventured to constitute of it a genus from such dried specimens, as in which he confesses he never saw the character: he has called it *Œdipodium*, and has separated it from *Gymnostomum*, because it has "peristomium nullum aut exigua membranula indivisa." Now, *every* moss possesses this "membranula indivisa," arising from the lining of the theca; but in all the species of *Gymnostomum*, it is peculiarly evident at some particular stage.

In our description of the fructification, we have noticed the columella, which, in some few species, is of a most remarkable form. Dr HOOKER has delineated a curious example in *G. Xanthocarpum*, and we have added that of *G. pyriforme* in one of the plates accompanying this paper. In the latter, if a specimen be taken before the fructification be quite mature, and the operculum with the opercular membrane be forcibly, but carefully detached, we perceive a membranaceous expansion, which, if the sporules be removed, resembles an inverted cone, the base or superior

portion of which, is attached all round to the sporular bag at the margin of the theca. That part of this membrane which unites the lining of the theca to what is usually called the summit of the columella, is in this genus commonly of a strong nature,—so much so, as to induce Mr BROWN, and also ourselves at one time, to conclude that *G. microstomum* * possessed a horizontal membrane actually arising from the wall of the theca. This, however, is not the case: but even supposing it were so, the difficulty of examination is so great, and the membrane itself so evanescent, this character alone would be but of little use, though certainly sufficient to remove any plant from the true *Gymnostoma*.

With the membrane which covers the sporular bag, the peristome of *Leptostomum* must not be confounded. In that genus, Dr HOOKER remarks, that the peristome is very near that of *Diphyscium*; and we add, also, to the internal peristome of *Buxbaumia* and *Ptychostomum*, (HORNSCH.)|; but *Leptostomum* and *Ptychostomum* we think more naturally allied to *Bryum*.

We have already mentioned that some species possess an annulus. Dr HOOKER, in his "Musci Exotici," has figured two, *G. julaceum* and *involutum*. WEBER and MOHR (Handbuch, p. 86.) first pointed out this part in *G. tenue*,—"Arte solventes operculum, annulum s. fimbriam, cujus nec HEDW. nec SCHRAD. mentionem fecerunt, observavimus." This was soon afterwards also observed by RÖHLING. To these three must be added, *G. trichodes*

* Mr BROWN constitutes of this plant his genus Hymenostomum, with the character—"Stoma edentulum, clausum epiphragmate (e membrana exteriore orto), disco tenuissimo (a columello libero) mox rupto et evanido; limbo persistente, horizontali indiviso."—Linn. Trans. v. 12. p. 572.

(Weber and Mohr), the *Weissia trichodes* of Hook. and Tayl., and *Grimmia trichodes* of Smith, which we conceive to belong to this genus.

We shall conclude our observations, by noticing, that Sir James Edward Smith alludes to the Hyssop of Solomon being contained in this genus, and states it (according to the Linnean Herbarium) to be *G. fasciculare* *. Weber and Mohr do not seem certain as to the species; and Palissot de Beauvois, without assigning any reason, changes it into a *Phascum*, as, when speaking of the Phasca, he observes, "parmi lesquelles on croit reconnoitre l'Hyssope de Salomon." The last notice of this subject is to be found in Mr Gray's extraordinary work on British Plants, where he gravely adds, and with his usual brevity, the following *synonym*, under *Gymnostomum fasciculare*: "*The hyssop that groweth on the wall.*—English Bible."!

We shall only add to the above, conceiving the whole to be a matter of mere speculation, on which every one has a right to say what he pleases, and without much danger of refutation, that it is as probable that the hyssop may be neither a species of the genus *Hyssopus* nor of *Gymnostomum*. If we examine the New Testament, we shall perceive, that at the time of our Saviour's crucifixion, when he thirsted, that they filled a sponge with vinegar, and placed it on *hyssop*, "ὑσσώπῳ περιθέντες," in order to extend it to him, (St John, ch. xix. v. 29.) Now, Matthew uses a different expression; he says, they put the sponge on a *reed*, "καὶ περίθεις καλάμῳ," (Matth. ch. xxvii. v. 48.) And Mark, (ch. xv. v. 36.,) confirms this, "περίθεις τε καλάμῳ." From these authorities, one might infer, either, that hyssop was a reed, or, as καλάμος

* Fl. Brit. p. 1166. and Eng. Bot. t. 1245.

may be a wand, or slender branch of any kind, so ὑσσώπου is the bush or tree from which the twig was taken; but whichever be the reading, the hyssop of St John can neither be the herb known at this day under that name, nor any of the Musci. In interpreting rigorously the passage in 1. Kings, ch. iv. v. 33. we do not find any thing dissonant to this: "And he spake of *trees* (*lignis* in the Vulgate, and ξύλων in the Septuagint), from the cedar that is in Lebanon, even unto the hyssop that springeth out of the wall." But might not hyssop have been the name for *any* small plant, in contradistinction to the magnificent cedar *?

Hab. Gymnostomum is a genus widely distributed in every quarter of the globe, each claiming a greater or less number of species; temperate climates are, however, the most favourable to their production. Most of the species are found on the ground, some on rocks, and one only, that we are aware of, on trees (*G. viridissimum*). Those most rare

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* As this subject has excited no small interest with many speculators, we shall add here the literal translations in Latin of the passage, taken from different Versions.

1. Hebrew—"Et locutus est super *lignis* a *cedro* quæ in Lebanon, et usque ad *hyssopum* quæ egrediens in pariete."
2. Syriac—"Disseruit etiam de *arboribus*, a cedris Lebani usque ad *sempervivum* quod prodit in pariete."
3. Arabic—"Locutus est de *arboribus*, et exposuit virtutes earum; disseruit autem de quibuscunque *arboribus*, a cedro Libani usque ad *herbam* quæ nascitur in pariete."
4. Greek—"Et locutus est de *lignis*, a cedro quæ est in Libano, et usque ad *hyssopum* egredientem per parietem."
5. Vulgate—"Et disputavit super *lignis*, a cedro quæ est in Libano, usque ad *hyssopum* quæ egreditur de pariete."

It will be remarked, that the Syriac and Arabic use a different phrase from hyssop. The Chaldee Version has not this passage at all, but a totally different one in its place.

in this country are, *G. Griffithianum*, *trichodes*, *conicum*, and *Donianum*. The first has been gathered on Ingleborough, Snowdon, and the mountains of Angusshire; the second in Sussex, and near Dublin; the two last are abundant in the very few stations in which they are found. *G. conicum* is, according to Mr MACKAY, too frequent in the Dublin Botanic Garden; and *G. Donianum* we have recently had the pleasure of rediscovering, in the utmost profusion, in Mr DON's old and only station, the Den of Dupplin, Perthshire. Very few *Gymnostoma* are to be met with on elevated mountains, though many occur in subalpine districts.

HIST. The Mosses composing the present genus, formed with DILLENIUS and LINNÆUS a part of *Bryum*. At that period no attention was paid to the peristome; but as soon as HEDWIG commenced his work of reformation, the genus *Gymnostomum* was established: and at the same time was described another genus nearly allied to it, by the name of *Hedwigia*, the same as *Anictangium* of the Species Muscorum. In that work fifteen *Gymnostoma* are published, and seven *Anictangia*, from which must be deducted, as being varieties, or belonging to other genera, the following; from *Gymnostomum* five (of which one is *Schistostega*), and from *Anictangium* six species (of which one is a *Gymnostomum*, and another an *Hedwigia*). In the first Supplement published by SCHWÆGRICHEN, twenty-four species of the one, and ten of the other, are enumerated. BRIDEL in his last work gives us no fewer than four genera formed out of the above, *Gymnostomum*, *Pyramidula*, *Schistidium*, and *Anictangium*; of which, the first contains thirty species, the second one, the third six, and the last two: *Pyramidula*, however, is a true Gymnostomum, and ranks next to *G. pyriforme*, and of his two species of *Anictangium*, the

one is a variety of a *Gymnostomum*, and the other an *Orthotricum*. Upon the whole, there are scarcely more than twenty-nine or thirty true species known of *Gymnostomum*, including those described by Dr Hooker in Musc. Exot., (with the exception of Mr Brown's *Leptostoma*, which we conceive to form an excellent genus). In Great Britain, Sir James Edward Smith enumerates sixteen species (Fl. Brit.); these he increases in his Compendium to twenty; but Drs Hooker and Taylor, in their Muscologia Britannica, reduces them to fourteen.

There are a few plants which require to be noticed in this place, some of which have been denied to belong to this genus, and others improperly retained.

Œdipodium, the new genus constituted by Schwægrichen, we have already mentioned. *Gymnostomum trichodes* has been described by Hedwig as an *Anictangium*, by Smith as a *Grimmia*, and as a *Weissia* by Drs Hooker and Taylor. We are more inclined to follow Weber and Mohr, and other authors, who deny it a peristome, than those who hold a contrary opinion. The authors of the Muscologia Britannica observe,—"The curious peristome of this plant, in an early stage, represents only a membranous ring, lying horizontally within the edge of the mouth of the capsule: this, however, as maturity advances, splits into sixteen equal, short, and very obtuse teeth, which become erect, and afterwards reflexed over the mouth of the capsule." Sir J. E. Smith, in Eng. Bot. tab. 2563, also remarks, "Mr Borrer observes, that the fringe seems a continuation of the inner coat of the capsule, and looks at first like a thin inflexed membrane, nearly closing the mouth; afterwards, when dry, it becomes reflexed, forming sixteen very short, blunt, flat, and pale teeth, and soon falls off.—Mr J. D. Sowerby found each tooth divided by a line, transversely furrowed,

and occasionally emarginate *. Now, it should be observed, that these teeth, which are acknowledged to arise from the interior of the theca, appear to be a continuation of the lining; whereas, in all the *Weissiæ*, the teeth either spring from the surface of the stoma, or immediately from within; and are formed at the same time with the theca itself; but the supposed teeth being thus only formed by the splitting of the horizontal membrane which connects the lining of the theca with the summit of the columella (and which we have already remarked to be peculiarly strong in *Gymnostomum*), the plant should perhaps be retained among those destitute of a true peristome †.

Dr HOOKER has published a new and singular species of *Gymnostomum* in his exquisite Musci Exotici ‡, under the name of *Capense*, which Mr BROWN conceives to form of itself a distinct genus, named by him *Glyphocarpa* ‖. Unfortunately the latter has published no character; but, whatever it be, it assuredly ought not to rest on the form or striæ of the theca, as, by the same principle, *G. Lapponicum* might also be removed; and *Bartramia arcuata*, on

* By the plate in English Botany, the peristome is decidedly that of an Orthotrichum; and indeed were the Muscologia Britannica and English Botany description of *actual teeth* to be correct, we would feel rather inclined to constitute of this a new genus, and arrange it close to *Calymperis*, in the *Orthotrichoideæ*.

† Since the plates for this paper have been engraved, we have observed, in *Gym. microstomum*, a similar structure, the horizontal membrane, which is usually striated, being, by age, turned upwards into sixteen very obtuse teeth. May not, in a similar way, *Weissia affinis* of HOOKER and TAYLOR's Muscologia, be merely *Gymnostomum conicum*, from which it does not otherwise differ?

‡ Musc. Exot., vol. ii. t. 165.

‖ Linn. Trans. vol. xii. p. 575.

account of its smooth theca, be separated from all the remaining Bartramiæ. As long, therefore, as generic distinction is rigorously taken from the fructification, it will, if Dr HOOKER's character be correct, remain in that group among which he has placed it.

Depranophyllum of RICHARD, first published by Dr HOOKER as a *Dicranum?* is another very extraordinary plant, which we have hitherto alluded to in the light of a doubtful *Gymnostomum*; the fact is, no character has yet been formed which excludes it from that genus. From its most peculiar habit alone, we have no hesitation in believing it to be totally distinct; at the same time, the little that is known about it, renders it impossible for us to notice it, except in this place *. SCHWÆGRICHEN also describes and figures it in his second Supplement, and makes the sole character depend on the naked male flowers. Were we to hazard an opinion, we should be inclined to consider it an *Anictangium*, and not far from *An. torquatum*, with which it has a considerable affinity; and if its calyptra be ultimately proved to be mitriform, we would feel inclined in that case to destroy the next genus we are to describe, *Schistostega*, and form the whole into a distichous-leaved section of *Anictangium*.

Species referable to other genera, are, *G. pennatum* (vid. *Schistostega*), *G. aquaticum* (vid. *Hedwigia*). *G. pulvinatum* and *subsessile* belong to *Anictangium*. *G. prorepens*, retained as such by all authors, we have ascertained to possess sixteen geminate teeth, without a capitate columella, so that it belongs to the *Orthotrichoideæ*. From an

* We wrote, some time ago, to our friend M. ACHILLE RICHARD, requesting him, if possible, to examine his father's specimens, and endeavour to discover something additional respecting the fructification. We have not yet been favoured with an answer to our queries.

examination of many specimens we have also ascertained that the calyptra is actually mitriform; though, from its irregular splitting at the base, it sometimes appears with one predominant fissure, or dimidiate, as in HEDWIG's figure: this plant is therefore a true *Orthotrichum* *.

PLATE II.

Fig. 1. Theca of *Gymnostomum Donianum*, shewing the elongated columella.
2. A young plant of the same species.
3. A mature calyptra of the same.
4. Theca of *Gym. microstomum*, with the membrane within the orifice.
5. Theca of *Gym. Griffithianum* exhibiting the same structure.
6. Theca of *Gym. viridissimum*.
7. Theca of *Gym. involutum* divided, to shew the columella.
8. Calyptra of the same.
9. Theca of *Gym. pyriforme*, with the expanded membrane within the mouth.
10. The mouth of the theca of the same dissected, and more highly magnified; it exhibits the summit of the columella expanding into a membrane which is attached to the top of the lining of the theca; the sporules are seen within.
11. Calyptra of the same species when full grown. In a young state it is almost mitriform.

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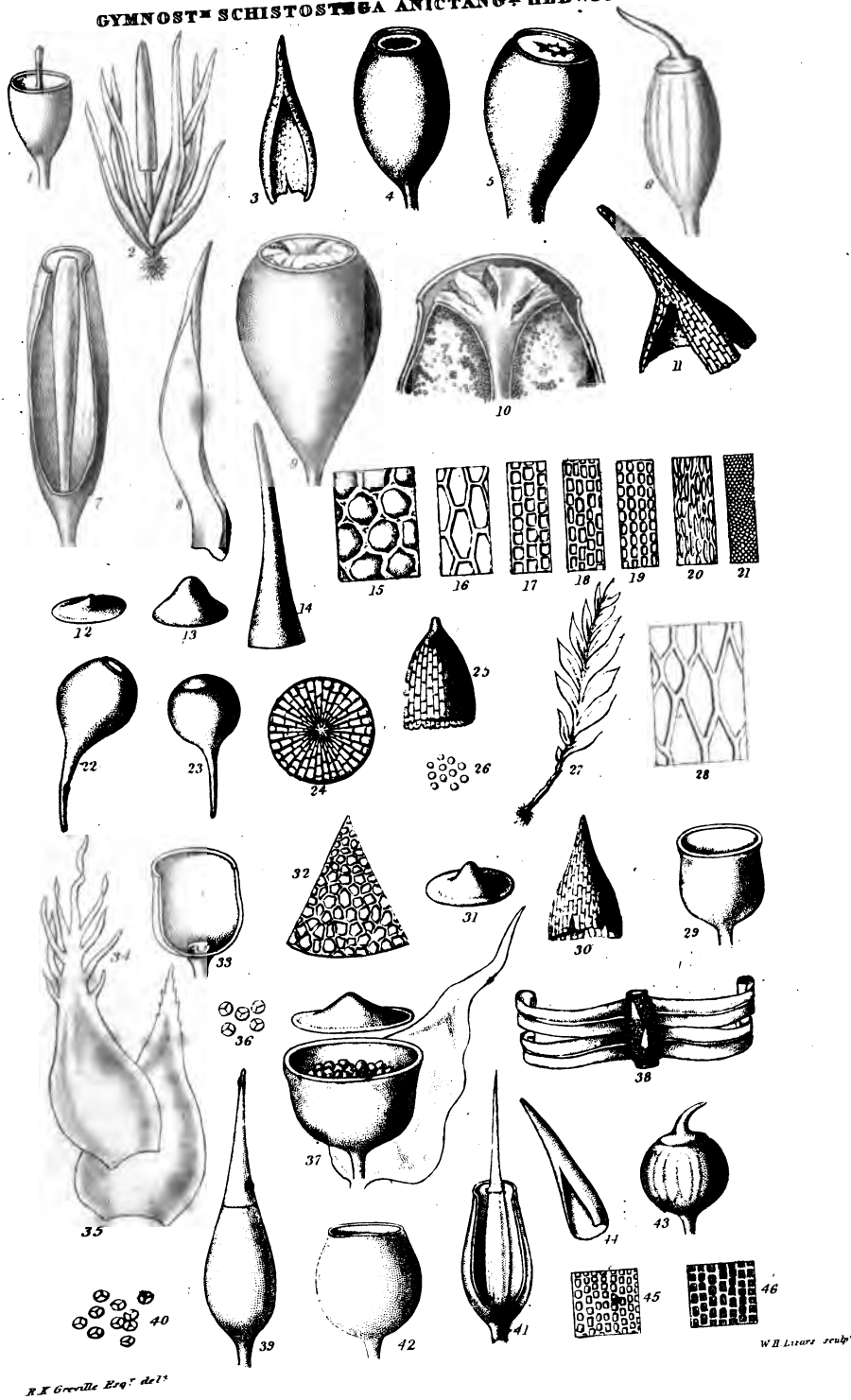
* We find that BRIDEL once formed a genus of this plant, called *Anodontium*, which Mr Brown seems rather inclined to favour, by mentioning, in Linn. Trans., vol. x. p. 315., that he had ascertained two new species. BRIDEL, however, in his *Methodus nova Muscorum*, reduces the genus again to *Gymnostomum*.

Engd for the Wern. Memoirs Vol V.P. 54, &c

PLATE II

GYMNOST.ª SCHISTOST.ª GA ANICTANG.ª HEDWIGIA.



R K Greville Esq.r del.t

W.H Lizars sculp.t

12. Operculum of *Gym. fasciculare.*
13. Do. of *Gym. conicum.*
14. Do. of *Gym. involutum.*
15. Cellules of the leaves of *Gym. Griffithianum.*
16. Do. of *Gym. pyriforme.* Similar to which are those of *Gym. fasciculare* and *Gym.* (Pyramidula) *tetragonum.*
17. Do. of *Gym. minutulum;* which may also serve to represent those of *Gym. truncatulum* and *ovatum.*
18. Do. of *Gym. Donianum;* resembling also those of *Gym. conicum.*
19. Do. of *Gym. Xanthocarpum.*
20. Do. of *Gym. tortile.*
21. Do. of *Gym. microstomum.* (The smallest reticulation of any of the *Gymnostoma.*)

All the figures more or less magnified.

Gen. VI. Schistostega, *Mohr.*

Fruct. *Calyptra* mitræformis*, basi integra, fugax, theca paulo brevior, tenera, pallido-fuscescens, laxe reticulata. *Seta* terminalis, cauli subæqualis, lutescens demum rufescens, erecta, capillaris, nunquam tortilis, apice paululum incrassata. *Apophysis* nulla. *Theca* integra, lævis, subglobosa, minutissima, maturitate luteo-fusca, ore contracto, incrassato, thecæ concolore† absque annulo. *Operculum* tenerrimum, convexiusculum, striato-reticulatum,

* —"integra secedit." Hedw. Stirp. Cr.

† —"luteo." Hedw, Stirp. Cr.

"non integrum, sed de summitate in lacinias irregulares illico sese revolventes decedens dilutissime rutilans *." *Peristomium* nullum. *Columella* maturitate nulla. *Sporulæ* exiguæ, globosæ, pallido-virides, hyalinæ.

CHAR. DIFF. *Seta terminalis. Theca ore nudo. Operculum laciniatum, laciniis deciduis. Calyptra campanulata, basi integra.*

FRUCT. *Calyptra* mitriform, entire at the base, fugacious, somewhat shorter than the theca, tender, of a pale brownish colour, and loosely reticulated. *Seta* terminal, equal in length to the stem, yellowish, at length reddish, erect, capillary, never twisted, somewhat incrassated at the apex. *Apophysis* none. *Theca* entire, smooth, subglobose, excessively minute, yellowish-brown when mature; orifice contracted, with an incrassated margin, without an annulus, and of the same colour as the theca. *Operculum* delicate, slightly convex, reticulated in a striated manner; "not entire, but splitting from the centre into irregular laciniæ, which are revolute and deciduous, and of a very pale red colour." *Peristomium* none. *Columella* in the mature theca none. *Sporulæ* exceedingly minute, globose, pale green, pellucid.

DIFF. CHAR. *Seta terminal. Theca with a naked mouth. Operculum laciniated, the laciniæ deciduous. Calyptra campanulate, entire at the base.*

VEG. The roots of *Schistostega* are simple or branched, of a brownish colour, and pellucid. The stems are simple,

* HEDW. Stirp. vol. i. p. 78.

or most rarely branched, one to three-fourths of an inch in length, filiform, erect, and flexuose; naked from the base to about two-thirds of the whole length, when it becomes clothed with distichous leaves of a lanceolate form, plane, bright green, nerveless, entire, and loosely reticulated;—"they are decurrent at the base, but by no means confluent; those in the centre are the longest, and they gradually diminish in size above and below*." The perichætial leaves are much narrower than those of the stem.

Obs. The calyptra of this moss we have found, by careful examination, to be campanulate, or entire, as Hedwig describes it. Few authors seem to have noticed it since his time from their own observation. As to the operculum, we have borrowed part of our character from Hedwig, having never been able to satisfy ourselves completely respecting the laciniæ, but this we shall mention more particularly when we come to the history. If we consider the excessive minuteness of the theca, its form, and naked stoma, no other known moss can be confounded with it; the foliage, however, much resembles that of *Dicranum bryoides*, for which, as Dr Hooker remarks, it has probably been frequently passed over. Among the *Gymnostomoideæ* it approaches to *Drepanophyllum* alone.

Hab. This singular moss seems to be confined to Europe, and hitherto has chiefly been observed in the northern division. In Britain, the only known stations are in Devonshire, where it was originally discovered by the Reverend Mr Newberry, on the road from Zele to South Tawton Church, four miles from Okehampton. This habitat, about

* Hook. and Tayl. Musc. Brit.

three years ago, we spent some days in examining without success. Since that time, however, this plant has been rediscovered by our friend the Reverend J. S. Tozer, who finds it on hedge-banks by the side of the Kingsbridge Road, a few yards after leaving the old road from Totness to Plymouth; also near the village of Harberton, about two miles and a half from Totness; and near Chelwill, in the same parish. He has likewise a fourth station, at Meavy Parsonage, near Horrabridge. Mr Tozer also writes, "I have invariably found it in the hollow mouldering part of our high hedges, the earth of which as the summer advances scales off, and renders it difficult to detect at that season of the year." Smith's account agrees well with this: "In cavitatibus aggerum, sub sepibus vetustioribus, solo pingui *."

Hist. This moss was first described by Dickson †, under the name of *Mnium osmundaceum*. Hedwig very soon afterwards published it in his "Stirpes" as a *Gymnostomum* ‡; and Ehrhart, about the same time, as *Dicksonia pusilla*, in his "Plantæ Cryptogamæ." It was still continued, however, as a *Gymnostomum* (*G. pennatum*) by Hedwig in the Species Muscorum, and by Schwægrichen in the Supplement. Mohr, in 1803 and in 1807, conjointly with Weber, made a distinct genus of it, on account of the remarkable operculum, and named it *Schistostega*, a genus which is retained by the authors of the British Muscologia. Hedwig, in his Stirpes already quoted, thus describes the *operculum*: "Non integrum, sed de summitate in lacinias irregulares illico sese revol-

* Fl. Brit. p. 1161.

† Crypt. Fasc. i. p. 3. t. 1. f. 4.

‡ Vol. i. p. 77. t. 29.

ventes decedit." Weber and Mohr say, "Operculum ab apice fissum in lacinias revolvendo-aufuges." Schkuhr, positively denies this structure; and Bridel, in his last work, "Methodus nova Muscorum," fully agreeing with that author, observes at some length,—"Schkuhrius acerrimus muscorum investigator e soli veritati studens, Hedwigium graviter erravisse in observatione, descriptione et adumbratione hujusce musci operculis, nos edocuit: Hedwigius nempe illis striis tenerrimis a centro ad perisphæriam radiantibus ornatum esse, nec integrum sed de summitate in lacinias irregulares illico esse revolventes ac delabentes (quod casu semel fieri potuit) discedere affirmat. Tanta auctoritate moti Weberus Mohrusque, imo idem se observasse dictitantes novum genus *Schistostega* a fisso operculo dictum effinxerunt. Schkuhrius autem diu et pertinaciter hujusce musci capsulam percontatus operculum nec aliter reticulatum nec alio pacto quam in cæteris muscis abscedens invenit, quamvis valde tenerum fugaxque esse fateatur. Genus igitur *Schistostega* natura repudiat ipsa, et nomen illud in Muscologia non aliter quam *Trentepohlia* remanebit, nempe, argumenti instar optimos observatores facile in errorem delabi, si naturam paulo segnius aut mente jam præoccupata scrutantur."

Notwithstanding the high authority of Schkuhr, and Bridel's opinion of him, and we are led to believe that Schwægrichen now agrees with them on that point, we certainly cannot suppose that Hedwig's description of the laciniated operculum originated wholly in imagination. Mr Tozer, who has examined this part very attentively, informs us, that one, which he placed under the microscope, split, on being touched, into many segments radiating from the *circumference to the centre;* which, though it contradicts Hedwig's character, "de *summitate* in lacinias," &c.,

yet contributes to establish the existence of a peculiar structure *. We ourselves, after repeated scrutiny, and lately, even in company with the learned authors of the Muscologia Britannica, have not been so fortunate. We could, however, perceive a series of striæ filled up by a reticulated vasculose structure, which, under favourable circumstances, might split in the manner described. Upon the whole, therefore, (not forgetting the uncommon habit of the plant, so unlike any *Gymnostomum*), we feel inclined, with Mohr, to consider it as a distinct genus. Besides, the calyptra is distinctly entire, which is sufficient of itself to remove it from *Gymnostomum*.

PLATE II.

Fig. 22. & 23. Thecæ of *Schistostega pennata*, the first without the operculum.

24. Operculum of the same, shewing the striated and vasculose structure, as it appeared to *us*.

25. Calyptra of the same.

26. Sporules.

27. An entire frond.

28. Cellular structure of the leaf.

All the figures are more or less magnified.

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* This structure, as far as we may judge by Hooker's Plate, appears also to exist in *Drepanophyllum*; unless this be owing to the remains of some teeth lurking in the interior, as we have perceived in *Hedwigia Schmidtii* (Hook.); in that case, *Drepanophyllum* must be again removed to the *Dicranoideæ*.

GEN. VII. ANICTANGIUM, *Hedw.*

FRUCT. *Calyptra* mitræformis plus minusve ad basin in lacinias irregulares fissa, quandoque pseudo-dimidiata, pallida, lævis, glabra. *Seta* terminalis, perbrevis, sæpius vix ulla, recta, rigida, thecæ concolor. *Apophysis* nulla. *Theca* quandoque subcylindracea, plerumque tamen turbinata, integra, nec sulcata nec striata, lævissima, rutilans seu fusca, ore nudo, subamplo crassiusculo colore saturatiore. *Operculum* deciduum, integrum, umbonatum seu convexo-rostratum, thecæ concolor, irregulariter celluloso-reticulatum. *Peristomium* nullum. *Columella* valde collapsa, et in fundo thecæ retracta *. *Sporulæ* magiusculæ subsphæricæ, reticulatæ; in una specie tripartitæ, punctatæ.

CHAR. DIFF. *Seta terminalis. Theca ore nudo. Operculum deciduum, integrum. Calyptra mitræformis, basi irregulariter fissa.*

FRUCT. *Calyptra* mitriform, cleft more or less into irregular segments at the base, sometimes even pseudo-dimidiate, pale, without striæ, glabrous. *Seta* terminal, extremely short, sometimes almost none, straight, rigid, of the same colour as the theca. *Apophysis* none. *Theca* sometimes almost cylindrical, but generally turbinate, entire, smooth, neither sulcated nor striated, reddish, or brown; the mouth naked, usually large, somewhat thickened, and of a deeper colour. *Operculum* deciduous, entire, umbonate or convexo-rostrate, of the same colour as

* Una in specie solummodo bene observavimus.

the theca, irregularly reticulated. *Peristome* none. *Columella* collapsed into a minute globular mass at the bottom of the theca. *Sporules* rather large, subsphærical, reticulated; in one species tripartite, and punctated.

DIFF. CHAR. *Seta terminal. Mouth of the theca naked. Operculum deciduous, entire. Calyptra mitriform, cleft irregularly at the base.*

VEG. The stems of the species in this genus grow in a tufted manner, and are in all the species but one considerably branched. In *A. ciliatum*, *filiforme* (MICH.), *imberbe* * (HOOK. & TAYL.), *repens* (HOOK.), and *torquatum* (HOOK.), they are either decumbent or creeping; in all the others, erect. Those of *A. torquatum* are tomentose beneath; "caulibus ramisque inferne ubique tomento ferrugineo obsitis, stipulisque admixtis †." It is remarkable, that, in this genus, the leaves of most of the species are entirely destitute of a nerve,—a circumstance which assuredly contributes to mark a natural limit between it and *Gymnostomum*. A nerve, however, terminating in a piliferous point, is present in *A. pulvinatum* and *subsessile*; and there is a percurrent one, of a brown colour, and remarkable strength, in *A. torquatum*. In regard to form, the leaves are usually ovate, obtuse, acuminate, and sometimes serrated at the apex; but in *A. torquatum*, they are ligulate, somewhat undulate, and "when dry, are so much curled as to cover the whole upper surface of the stem; and if macerated for ever so great a length of time, continue involuted in a most remarkable manner ‡." It is also

* *A. filiforme* and *imberbe*, certainly do not differ from each other; and we are even inclined, along with WEBER and MOHR, and BRIDEL, to add them both to *A. ciliatum*.

† HOOK. Musc. Exot. t. 41. ‡ HOOK. loc. cit.

worthy of notice, that, in *A. torquatum*, they are distichous, while in all the other species they are "spissa imbricata." The perichætial leaves also vary, though not much, from each other. In *A. ciliatum* they are laciniated towards the apex, while the cauline ones are only denticulated. In *A. torquatum* they are erect, lanceolate, and imbricated, differing very widely from those of the stem.

Obs. The *Anictangia* bear considerable affinity to a few *Gymnostoma*, and in some instances come near to several *Grimmiæ*; from all of which, however, a slight examination shews them to be sufficiently distinct*. The genus, if the species be compared with each other, seems to divide naturally into two sections; of which *A. ciliatum*, *imberbe*, *filiforme*, *repens*, and perhaps *subsessile*, would form the first.

The calyptras seem to vary exceedingly. In *A. pulvinatum*, Hedwig represents it almost dimidiate; but Schkuhr, with more accuracy, makes it mitriform, with a few fissures at the base. Schwægrichen figures and describes that of *A. subsessile*, "subcampanulata lateraliter secedens;" and Weber and Mohr agree by saying, "mitræformis in plures lacinias fissa, fissura una prævalente." Again, in *A. cæspititium*, Schwægrichen delineates it completely dimidiate, but describes it "conica, basi bis aut pluries fissa;" and Weber and Mohr, to reconcile all parties, say, "dimidiato-mitræformis." Bridel notices the contradiction between Schwægrichen's figure and description; "Calyptram Schwægrichenii icon valde diversam ab ejus

* With Grimmia, Anictangium has nevertheless been confounded; for, by an examination of Palisot de Beauvois' own specimens, we found his *Hedwigia (Anictangium) nervosa* to be nothing more than *Grimmia apocarpa*, var. β, or *Grimmia stricta* of Turner, Musc. Hib.

descriptione sistit." Notwithstanding all these discrepancies, as far as our own observations extend, the calyptra may be pronounced truly mitriform; and in most, nay, in all, the species hitherto known to us, more or less cleft into several basilar fissures. This circumstance shews how closely this genus is allied to *Gymnostomum*, for in *G. pyriforme*, and some others, the calyptra is almost mitriform.

All the calyptras we have observed are glabrous; but RICHARD *, in MICHAUX's Fl. Bot. Am., describes that of *A. filiforme* as subvillose; a fact doubted by WEBER and MOHR, who suggest, "an lusus naturæ?" and also by BRIDEL, "quod accuratius inquirendum." Unfortunately in those specimens received from M. ACHILLE RICHARD, we have not been able to discover a single calyptra; but in others, from Boston, sent us lately by Mr GREENE, we have at length detected it, and found it apparently furnished with a few hairs. It ought, however, to be remarked, that, in this American variety, the ciliæ, towards the extremity of the perichætial leaf, are so extremely brittle, as soon to render the leaf only serrated, and, from the structure of the hairs on the calyptra, we have little doubt that they are simply the broken and detached ciliæ of the leaf: we therefore still consider the calyptra to be, strictly speaking, glabrous.

HAB. The *Anictangia* appear to be as widely distributed as their neighbours the *Gymnostoma*. Europe,

* On examining the Herbarium of RICHARD, we found the following excellent description of this variety, which we take the liberty to publish:— "Folia arcte quasi squamatim imbricata, ovalia acuminata; involucri folia superne ciliata; operculum conoideum, muticum; calyptra caduca, oblonga, conoidea *subvillosa*; peristomium nudum."

North and South America, and New Holland, possess a greater or less number. The species so abundant in this country was found by Mr Brown in Australia, and has recently been sent to our friend Dr Hooker, from Nepal. *A. imberbe*, found in Ireland, does not appear to differ from that in North America. All, we believe, grow either on the ground or on rocks.

Hist. We have adopted the genus nearly according to the definition given by Mr Turner in his Muscologia Hibernica, and by Drs Hooker and Taylor in the Muscologia Britannica, which differs considerably from that given by Hedwig. It is the same as *Hedwigia* of Palisot de Beauvois, but more precisely the *Schistidium* of Bridel, whose *Anictangium*, by the definition, is the *Hedwigia* of Hooker. One species, *A. ciliatum*, was indeed described by Ehrhart, and by Hedwig in his Stirpes, under the name of *Hedwigia*; but that name was afterwards changed in the Species Muscorum to *Anictangium*; which species, it may be observed, was called a *Sphagnum* by Dillenius, and made by Linnæus (under the generic name of *Bryum*) a variety of *Grimmia apocarpa*.

In the Species Muscorum seven species are enumerated, of which one only ought to be retained. Schwægrichen, in the Supplement, describes ten, from which eight may be rejected; but, at the same time, two of his *Gymnostoma* should be added. Bridel's *Anictangium*, on which we shall enlarge in the next genus, contains two plants, neither *Anictangia* nor *Hedwigiæ*. In this country, Mr Turner was the first to adopt the genus, and describe one species; another was added in the Muscologia Britannica; two more in the Musci Exotici; and one,

which we have however not seen, has been described by SPRENGEL in his "Neue Entdeckungen."

The principal alterations made in this genus, since SCHWÆGRICHEN published the Supplement, consist in the rejection of *A. setosum*, *bulbosum*, *planifolium*, and *cirrhosum*. The first, as a *Neckera*, and the second as a *Hookeria*, have been beautifully delineated by Dr HOOKER in his Musci Exotici, which may be consulted for further information. *A. planifolium* is still undecided, and from not having been seen by SCHWÆGRICHEN, is probably not in HEDWIG's Herbarium. It appears not to differ materially from *Hypnum aciculare*, as SCHWÆGRICHEN himself conjectures; and there is little doubt of its having a double peristome. As to *A. cirrhosum*, it is most wretchedly figured in the Species Muscorum; but has, in the second part of the first Supplement, been called a *Schlotheimia*. BRIDEL also coincides in this. WEBER and MOHR in their Synopsis Muscorum make it a *Ulota*. We regard it as an *Orthotrichum* *, thinking that *Schlotheimia*, *Ulota*, and *Macromitrion*, do not essentially differ from that genus.

PLATE II.

Fig. 29. Theca of *Anictangium ciliatum*.
30. Calyptra of the same.
31. Operculum do.

* We allude here to a plant which is not uncommon in herbaria in this country, under HEDWIG's name. This has very long leaves, *serrated* towards their extremity. But is this really HEDWIG's plant? We must trust to SCHWÆGRICHEN, and the German muscologists, for information. We also possess another, perhaps more likely to be the true *A. cirrhosum*, as it has entire leaves; this, again, we consider only a variety of *Orth. pallidum*, (P. B.)

32. Structure of the operculum of the same.
33. Theca of the same divided, to shew the retracted and small columella at the bottom.
34. A perichætial leaf, and,
35. A cauline leaf of the same species.
36. Sporules do.
37. Theca and perichætial leaf of *Anict. repens*; copied from HOOKER.
38. Cauline leaves of *Anict. torquatum.*
46. Structure of the leaf in *Anict. ciliatum:*
All the figures more or less magnified.

GEN. VIII. HEDWIGIA.

FRUCT. *Calyptra* dimidiata, thecæ subæqualis, scariosa (ut in fere omnibus muscis), straminea. *Seta* lateralis, tres ad octodecim lineas longa, plerumque caules longe superantes, rigida, stricta vel rarius tortilis, fusca, ad summitatem sæpius incrassata. *Apophysis* nulla. *Theca* integra, lævissima (in una tantum specie siccatione sulcata) vel globosa, vel subcylindracea, fuscescens, ore nudo, in quibusdam amplo, in aliis contracto, in omnibus? crassiusculo, rubescenti. *Operculum* deciduum, integrum, subulatum vel rostratum, thecæ concolor. *Peristomium* nullum. *Columella* filiformis *. *Sporulæ* (in *H. aquatica*) sphæricæ, tripartito-reticulatæ, pellucidæ.

* In una specie subulata, stricta, ad operculi apicem porrectens, siccitate sulcata; in cæteris plane nobis ignota.

CHAR. DIFF. *Seta lateralis. Theca ore nudo. Operculum deciduum, integrum.*

FRUCT. *Calyptra* dimidiate, nearly as long as the theca, scariose (as in most mosses), yellowish. *Seta* lateral, three to eighteen lines in length, mostly rising considerably above the stem, rigid, straight, brown, often somewhat incrassated at the apex. *Apophysis* none. *Theca* entire, very smooth (in one species sulcated when dry), globose or subcylindrical, brown; the mouth naked, large in some, and contracted in others, always? somewhat thickened and reddish. *Operculum* deciduous, entire, subulate or rostrate, of the same colour as the theca. *Peristomium* none. *Columella* filiform. *Sporulæ* (only observed in *H. aquatica*) spherical, tripartite, and pellucid.

DIFF. CHAR. *Seta lateral. Theca with a naked stoma. Operculum deciduous, entire.*

VEG. The stems of the *Hedwigiæ* are much branched, as might be generally inferred from the fructification being lateral. In one species they are floating, in another procumbent, in the others erect; in *H. Hornschuchiana* they are also densely matted. *H. Humboldtii* and *secunda* are branched in a subpinnated manner. The leaves differ much in shape, passing from obovate to subulate, and are in some species destitute of a nerve; but there is one in *H. aquatica*, and one also remarkably broad in *H. Hornschuchiana*. The leaves are rarely piliferous, and as rarely serrated; they are smooth or striated, inserted on all sides of the stem, erect, and sometimes flexuose or secund.

OBS. Several species of this genus bear a strong resemblance by their leaves to *Anictangium*. *H. Hornschuchi-*

*ana** in habit comes near to *Gymnostomum rupestre*. Some are also in habit nearly allied to several *Leucodontes*, to *Hypnum*, *Fontinalis*, and to some *Neckeræ*. Indeed, were it not from a wish to bring all the Gymnostomoid plants together (on account of their characteristic fructification), we would have confined that tribe to those genera furnished with *terminal* setæ alone, and have removed *Hedwigia* to the Hypnoid division.

The calyptra seems in all to be strictly dimidiate. JACQUIN, in his Flora Austriaca, made it mitriform, but he had only seen it in a young state. "Calyptra mihi pluries omnino dimidiata subulata, cuculliformis," says BRIDEL, and we entirely accord with him.

HAB. These plants are natives of Europe, South America, Guadaloupe, and some of the South Sea Islands. None are found in Britain, though *H. aquatica* is by no means very rare on the Continent. Their situation is various, some growing in water, others on rocks and trees. They seem also to be exposed to a considerable range of temperature; from the mild rivulets in the south of France to the "loca frigida" of the Andes.

HIST. The only species known to DILLENIUS and LINNÆUS was described by them as *Hypnum aquaticum*. HEDWIG, in his Stirpes, changed the generic name to *Hedwigia*; but afterwards, in his Species Muscorum, removed it to *Anictangium*, in which he was followed by SCHWÆGRICHEN in the Supplement to that work. The

* May not SCHWÆGRICHEN's conjecture be correct? "H. Hornschuchiana ambigua videatur, nisi forte flos femineus initio, etiam terminalis sit, et tantum per caulis innovationem lateralis reddatur." We ourselves have little doubt on the subject, and only hesitate to remove this plant to *Gymnostomum*, until we shall have an opportunity of examining more specimens.

analysing authors of the Muscologia Britannica first clearly explained, in the preface to their admirable work, the proper method of separating this genus from its allies; and Dr HOOKER, in Musci Exotici, has added several species. BRIDEL's definition of *Anictangium*, "PLEURO-CARPI; *stoma nudum*; *calyptra dimidiata subulata*," does not separate it from *Hedwigia*; and it is curious that the two "*undoubted*" species which he describes, are plants of two other genera, the one being a *Neckera*, and the other a *Gymnostomum*; and *Hedwigia aquatica*, which has truly lateral setæ, he places under *Gymnostomum*, characterised by its terminal setæ!

In regard to the new species published by Dr HOOKER, one was called an *Anictangium* by HORNSCHUCH; and another is the *Leucodon Canariense** of SCHWÆGRICHEN and other authors. Of this, Drs HOOKER and TAYLOR, in the Addenda to the Muscologia Britannica, remark, "We have received plants of *Leucodon Canariense* (Schwægrichen) from our late lamented friend Professor SCHMIDT of Norway, which he gathered in the Canary Islands; and we can safely assert that it does not belong to this genus." In Musci Exotici, we accordingly find this plant figured and described as *Hedwigia Schmidtii*, but, probably by an oversight, there is no mention made of its being identical with *Leucodon Canariense*, which we find to be the case, from the examination of specimens of the *Hedwigia* re-

* We might perhaps add to these *H. Humboldtii*, of which we have seen specimens received by Dr HOOKER from Guadaloupe, under the name of *Hypnum taxiforme* (BRID.), and said to have been named by SPRENGEL. We are afraid yet to assert them to be identical, until we have seen SCHWÆGRICHEN or BRIDEL's plant, especially as that from Guadaloupe does not well agree with their descriptions. May not, however, *Hyp. nigrocaule* be the same with *Hed. Humboldtii*?

ceived from Dr HOOKER himself, and compared with the *Leucodon*, which was presented to us by botanical friends abroad. In this moss, the same learned bryologist remarks, "Capsula ore contracto, intus membrana annulari alba;" and afterwards, "The annular membrane within the mouth of the capsule of this moss was noticed by its lamented discoverer Dr CHRISTIAN SCHMIDT, and it is very evident in all the specimens I possess."

Notwithstanding, this plant is really a *Leucodon:* we observed the above mentioned membrane exhibiting, as it were, traces of sixteen separate teeth, each furnished with a dark longitudinal line; and it gave us therefore no small pleasure to find the sixteen broken-off parts of the teeth adhering closely to the interior of the operculum. Thus, DILLENIUS's figure, tab. 89. f. 41. is more accurate than has been supposed.

PLATE II.

Fig. 39. Theca of *Hedwigia aquatica*, with the operculum on.
40. Sporules of the same.
41. Theca of the same divided, to shew the columella, which is elongated to the summit of the operculum.
42. Theca of *Hedw. Hornschuchiana.*
43. Theca of *H. Humboldtii*, copied from HOOKER.
44. Calyptra of the same.
45. Structure of the leaf in *Hedw. aquatica.*
All the figures more or less magnified.

BUXBAUMOIDEÆ, *Gen.* (9—10.)

CHAR. *Calyptra mitræformis, fugax. Seta terminalis. Theca gibba, obliqua, margine oris plus minusve crenulato. Operculum conicum. Peristomium, membranum conicum longitudinaliter plicatum ex interiore ortum, sine vel cum peristomio exteriore e processubus filiformibus constante. Columella perlonga ad operculi summitatem porrectens.*

CHAR. *Calyptra mitriform, fugacious. Seta terminal. Theca gibbous, oblique, the mouth being more or less crenulate. Operculum conical. Peristomium furnished with a conical membrane, longitudinally plicate, arising from within the stoma, either without, or accompanied with, an external peristome of numerous filiform processes. Columella very long, reaching to the summit of the operculum.*

OBS. The two genera we have here associated together are most nearly connected, as well by the peculiar form of the theca, as by the similar, conical, plicate, white membrane, with which the stoma is furnished.—"Of the propriety," says Dr HOOKER, "of their being placed next each other there can be no question, notwithstanding that one has a single peristomium, and the other a double one; their habit requires it; and if we were to consider alone the number of these parts, there would be no difficulty in assigning them a situation; the one to be last in the division of mosses with the single peristomium, the other the first in those with double ones. Yet this would, in other points of view, be unnatural, *Diphyscium* having more affinity with the genus *Leptostomum*, and some of the *Gymnostoma*

with membranous borders to the mouth, than with *Weissia*, *Dicranum*, and *Trichostomum*." Dr HOOKER proceeds, however, to state, "I therefore think that our two genera might be brought near to *Leptostomum* of BROWN, in consequence of their being furnished with a membranous peristome: and *Buxbaumia* may claim to be separated not only from the double-fringed mosses, but from the generality of the single-fringed ones, from the circumstance of the teeth, or cilia, not exhibiting any appearance of articulation, along with *Dawsonia* and *Polytrichum* *."

In much of these observations we readily concur, and have consequently assigned this place to the *Buxbaumoideæ*; in respect, however, to their affinity with *Leptostomum*, we cannot but dissent from Dr HOOKER, and consider that genus (as, indeed, has been already remarked by Mr BROWN) far more nearly allied to *Bryum*.

GEN. IX. DIPHYSCIUM.

FRUCT. *Calyptra* conico-acuminata, mitræformis, fugax, theca multo brevior, operculo subæqualis, membranacea, fuscescens. *Seta* terminalis, perbrevis, lævis, thecæ concolor. *Theca* dubie apophysata (interne columna cylindracea saccum sporuliferum sustinenti inferne insigniter dilatata), integra, lævis, "ovata obliqua supra parum depressa, sed basin versus gibbosa, subtus ventricosa," viciæ

* The two plants forming this group have been so ably and so fully described by Dr HOOKER in the New Series of the "Flora Londinensis," that our readers will find almost nothing additional in this portion of our paper; his descriptions are so accurate that we have frequently borrowed whole passages from that work, which we have marked by inverted commas.

sativæ seminis magnitudine, viridis, demum fusco-flavescens, foliis perichætialibus immersa; ore contracto, ad marginem sedecies? subcrenulato. *Operculum* elongato-conicum, rectum, deciduum, thecæ concolor. *Peristomium* simplex ex interiore ortum, "tenerum, membranaceum, albidum, conum efformans," erectum sedecies? "plicatum, striatum; siccitate subtortuosum." *Columella* permagna lævis, membranacea, ventricosa, elongata, ad operculi summitatem interiorem affixa; inferne fusca, superne alba. *Sporulæ* exiguæ, fuscæ, globosæ, pellucidæ.

CHAR. DIFF. *Thecæ peristomium simplex, membrana conoidea truncata plicata. Calyptra mitræformis.*

FRUCT. *Calyptra* conico-acuminate, mitriform, fugacious, much shorter than the theca, but nearly of the same length as the operculum, membranaceous, pale, brownish. *Seta* terminal, exceedingly short, smooth, of the same colour as the theca. *Theca* furnished with a dubious *apophysis* (having the small cylindrical pillar supporting the sporular sac dilated at the base), entire, smooth, "ovato-oblique, somewhat depressed above, but gibbous towards the base, ventricose below," greenish, at length brownish-yellow, immersed among the perichætial leaves; the mouth contracted, obscurely crenate at the margin into sixteen? segments. *Operculum* elongato-conical, straight, deciduous, similar in colour to the theca. *Peristomium* simple, arising from within the stoma, "delicate, membranaceous, white, forming a plicate cone," erect, "striated, when dry somewhat twisted." *Columella* very large, smooth, membranaceous, ventricose, elongated, fixed to the interior summit of the operculum, fuscous beneath, white above. *Sporulæ* very minute, fuscous, globose, pellucid.

DIFF. CHAR. *Peristome simple, formed of a conical, truncate plicate membrane. Calyptra mitriform.*

VEG. This plant grows in thick and often widely extended patches; including the leaves, it is not more than two or three lines in height. The stems are extremely short. The root is small, and, like a little mass of ferruginous down, similar to (what is usually called) *Conferva castanea**. The cauline leaves are few in number, and crowded, small in comparison with those of the perichætium, and various in their direction: they are crisped when dry, of a thick opake substance, and of a lurid green colour; they are also undulate, and slightly carinate, with a very entire margin and strong nerve. The lower leaves are lingulate and obtuse, with the nerve for the most part reaching to the apex; while the upper ones, or those immediately beneath the perichætium, are linear, subulate, "lanceolato-subulate" (WEB. and MOHR), "lanceolato-oblonga obtusa" (HOOK.), and the nerve somewhat excurrent; "folia infima nervo subexcurrente, folia media nervo subexcedente" (WEB. and MOHR); "folia utraque nervo sub apicem evanescente instructa" (HOOK.) The perichætial leaves are remarkably large for the size of the plant, "numerous, erect, exceeding the length of the theca, and almost covering it, oblongo-lanceolate, acuminate, a little convex towards the apex, having the margin remarkably laciniate, or rather lacerate; it has a strong, rigid, brown nerve, much exceeding the length of the leaf, and is there serrulate. The substance of these leaves is rigid, yet membranaceous; the colour yellow-brown."

* This *Conferva* we suspect may be nothing else than radicular filaments. Some other Confervæ, such as *C. velutina* (as Mr DRUMMOND has ascertained), and *C. Pteridis* (according to the observations of Captain CARMICHAEL), are in the same predicament.

Obs. Few mosses are more curious in the internal structure of the theca than *Diphyscium*. When a mature theca (from which we can alone expect to draw conclusions in any moss) is divided, we find a considerable space between the outer wall and the sporular sac, the intermediate pulpy matter having early dried up, and left nothing but "numerous whitish, branched, jointed succulent fibres" connecting these two parts together. The pulpy substance above mentioned, seems, at an early stage, to have extended in this moss considerably below the sporular bag, where it contained in its centre a small cylindrical pillar, which is left entire on the shrinking of the above substance, and acts as a supporter to the sporular bag, but is evidently of a different nature. A support of this kind seems peculiarly necessary both in this and the following genus, on account of the distance between the sporular sac and the wall of the theca. But it must not be understood that we give this pillar or support to *Diphyscium* and *Buxbaumia* alone: on the contrary, we have now every reason to suspect that it is common to most mosses; we have during this spring seen it in the junior state of *Didymodon purpureum*, but in none is it so beautiful as in *Bryum ligulatum* and *Gymnostomum pyriforme*; of which last we regret that our plates were too much advanced in the engraver's hands to add dissections of this part.

Within the sporular sac we have always found a columella, formed as usual by the turning up of the sac, but fixed with it to the summit of the little pillar above mentioned. The best mode of observing it, is to puncture a ripe sac, and by repeatedly plunging it in water, wash out the sporules; the sac may then easily be drawn down or away from the columella, which appears almost equal in size to the sac. The columella is furnished at its summit with an opercular membrane, of a whitish colour, reaching and

even adhering, to the summit of the operculum, well deserving the name, therefore, of elongated columella. Dr HOOKER says, "the extremity of the sac is lengthened out into a columella:" a minute dissection, however, very distinctly shews the columella to be continued from the base, and the sporular sac to be attached *to* it at the mouth of the theca. The columella, into which, according to Dr HOOKER, the sporular sac is lengthened out, is our opercular membrane; between which, and the summit of the columella *strictly* so called, the line of separation is very evident.

The peristome of this moss is worthy of much attention. It consists of a beautiful white, plicate, and slightly twisted cone. This HEDWIG considered to be formed entirely of ciliæ, connected together into a membrane furnished with sixteen sulcæ, or furrows. "I have myself seen," says Dr HOOKER, "what appeared to be distinct ciliæ, but whether they were really so, or only the plicæ of the membrane, I could not satisfy myself;" neither have we been able to trace any thing satisfactory beyond a mere ridge, formed by the duplication of the membrane.

Almost all authors describe the peristome of *Diphyscium* as double, mistaking the crenate margin of the theca for an outer one; but this appearance is, indeed, widely different from any thing like teeth. WEBER and MOHR observe, "Peristomium exterius vix ullum. Marginem oris crenulatum pro tali sumsit HEDW. EHRH. denegavit." Thus censuring HEDWIG, but adopting his opinion. BRIDEL and others represent the plicæ of the membrane as alternating with the crenulæ of the margin; in some cases we have clearly perceived this, but, as it depends upon the margin being cleft into a definite number of segments, it is rather uncertain whether it uniformly occurs.

Hab. Europe and North America, where it is chiefly found in subalpine countries, growing in woods, and dry, sandy, heathy places, on the ground.

Hist. This plant was described by Haller and Dillenius as a *Sphagnum*. By Schmidel it was added to *Buxbaumia*, a genus to which it has been also referred by Hedwig, Schwægrichen, and a great many modern authors. Jacquin and Necker at different times made it a *Bryum*. Hudson called it a *Phascum*, in which he was followed by Lightfoot and others. Ehrhart, finding the peristome to differ from *Buxbaumia*, threw it into a distinct genus, which he called *Webera*. Mohr, however, in his Observ. Bot. changed it to *Diphyscium*. *Hymenopogon*, the only other name it has since received, was bestowed by Palisot de Beauvois, who was not aware at the time of that of *Diphyscium*. His name is justly remarked by Dr Hooker, to be "so much more applicable, that we cannot but regret that it was published subsequently to Mohr's Observationes, which renders it impossible for it to be adopted."

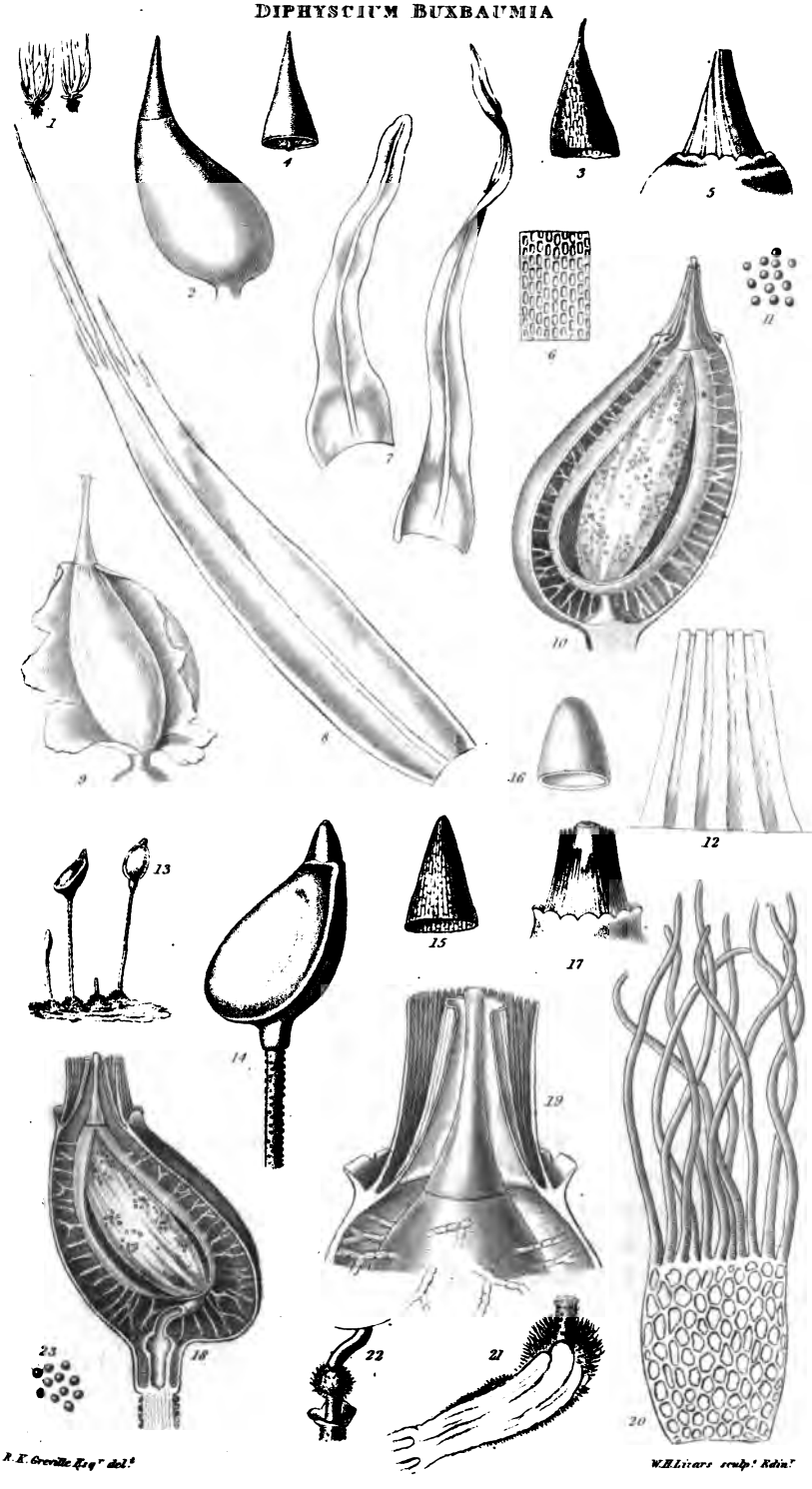
PLATE III.

Fig. 1. Plants of *Diphyscium foliosum*.
2. Theca of the same, with the operculum not removed.
3. Calyptra.
4. Operculum, with the upper part of the columella, which generally remains thus attached, if the operculum be forcibly removed.
5. Peristome and mouth of the theca.
6. Structure of the cauline leaf.
7. Cauline leaves.
8. Perichætial leaf.

PLATE III.

Engd for the Wern. Memoirs Vol. V. P. 78.

DIPHYSCIUM BUXBAUMIA



R. K. Greville Esq.r del.t

W.H. Lizars sculp.t Edin.r

9. The columella and sporular sac removed from the theca; the columella with its elongation, is shewn by dividing and throwing back the sporular sac. Precisely the same appearance occurs in *Buxbaumia*.
10. A mature theca divided, and exhibiting the sporular sac connected with the sides of the theca by white-jointed filaments; the columella with its elongation passing through the conical peristome; and the whole supported by the small column, to the summit of which both the columella and sporular sac are most firmly attached.
11. Sporules.
12. A portion of the peristomium highly magnified.

All the figures, except the first, more or less magnified.

GEN. X. BUXBAUMIA, *Haller*.

FRUCT. *Calyptra* conica vix acuminata, mitræformis, integerrima, fugacissima, brevis, membranacea, lævis, viridi-fuscescens. *Seta* terminalis, tres ad sex lineas longa, erecta, rigida, crassiuscula, cylindracea, tuberculata, nitidiuscula, ruberrima. *Apophysis* brevis, cylindracea, seta vix crassior, lævis, thecæ concolor, interne columna cylindrica saccum sporuliferum sustinenti medio in orbem inflata. *Theca* "magna, ovata, obliqua, supra plana, submarginata, basi producta vel gibba, infra convexa," "parte superiore tenera, inferiore membranaceo-carnosa;" colore "viridis, rubedine sæpe tincta, maturitate rufo-fusca," oris margine elevato crenulato. *Operculum* obtuso-conicum, breve, rectum,

decidium, læve, thecæ concolor. *Peristomium* duplex; *ext.* e "ciliis numerosis subæqualibus inarticulatis, subtorulosis, opacis, obscura rufescentibus; *int.* membranaceum, tenerum, albidum, conum efformans plicatum striatum," rectum haud tortuosum. *Columella* permagna lævis, membranacea, ventricosa, elongata, inferne fusca, superne pallida. *Sporulæ* exiguæ, globosæ, ex viridi fuscæ.

CHAR. DIFF. *Theca peristomii duplex; ext. e processubus filiformibus subconnexis; int. membrana conica plicata truncata. Calyptra mitræformis.*

FRUCT. *Calyptra* conical, scarcely acuminated, mitriform, very entire, fugacious, short, membranaceous, smooth, brownish-green. *Seta* terminal, three to six lines long, erect, rigid, thickish, cylindrical, rough with tubercles, somewhat shining, deep red. *Apophysis* short, cylindrical, somewhat thicker than the seta, smooth, of the same colour as the theca, within exhibiting the small pillar supporting the sporular sac, dilated in the middle into a little globe. *Theca* "large, ovate, oblique, above flattish, somewhat margined; at the base produced or gibbous, below convex; the substance in the upper part is thin and delicate, the rest between membranaceous and carnose; the colour greenish, often tinged with red, when ripe red-brown;" the margin of the mouth elevated and crenulate. *Operculum* obtusely conical, short, straight, deciduous, smooth, of the same colour as the theca. *Peristomium* double; *ext.* of "numerous, nearly equal, jointless, somewhat torulose, opaque, reddish cilia; *int.* membranaceous, delicate, whitish, forming a plicate and striated cone," erect, scarcely at all twisted. *Columella* large, smooth, membranaceous, ventricose, elongated, brown beneath, pale above. *Sporulæ* minute, globose, green, at length brown.

DIFF. CHAR. *Peristome double; ext. of filiform subunited processes; int. membranaceous, conical, plicate, truncate. Calyptra mitriform.*

VEG. The root of this most curious plant is rather more than a line in length, mostly tortuous, thick, fleshy, brittle, slightly hollow towards its extremity, which divides into two or three branches *. There is really no stem, but the leaves are situate on the summit of the root, and form to the naked eye a minute, brown, rough or bristly tufted mass, from the centre of which springs the seta. According to Mr BROWN, "the leaves of the barren plant are lanceolate, and but slightly divided. Those at the base of the female perichætium are even broader than the former, but more deeply cut, both laterally and at top, into several capillary segments; while the leaves which proceed from the surface of the perichætium are still more deeply divided, and their segments so much elongated, that the minute foliaceous base has been universally overlooked, and the perichætium consequently described as covered with hairs †." We have never been so fortunate as to meet with the leaves first mentioned by Mr BROWN, and, indeed, never saw a barren plant; but the rest we have examined, and they appear to differ considerably from each other, and not to resemble those of any known moss. Those on the summit of the perichætium are, as Mr BROWN observes, deeply divided, and terminate in remarkably long filamentous segments: indeed, unless very great care be taken in the examination, they may pass for mere bundles of long interwoven confervoid filaments. Those at the base of the perichætium are

* See GREVILLE in Wern. Trans. vol. iii. p. 447.

† Linn. Trans. vol. xii. p. 583.

the most easily examined; "the lower part is strongly reticulated; the reticulations very irregular, and the bars or cellular divisions remarkable, being uniform in their diameter, which is considerable, smooth, semitransparent, and of a peculiar inflated appearance, difficult to describe or represent. Before the leaf begins to contract, the reticulations cease, and a number of conferva-like filaments are produced, which seem to be seldom if ever jointed, but are long, and generally much entangled. The colour of all the leaves is a light-green, tinged with a brown that increases in age; but the filaments are even then generally diaphanous, and exactly resemble the dark-coloured filaments that are to be met with on every specimen towards the upper part of the bulb *."

Obs. What we have said under *Diphyscium*, equally applies to the structure of the interior of the theca of this "Regina Muscorum." The only difference seems to be, that the little pillar or column which supports the sporular sac (it may almost be called a continuation of the interior of the seta) is dilated half-way up, into a small hollow globe. The economy of this part we have not been able to conjecture, nor have other botanists been more successful. Our observations relative to the peristome of *Diphyscium* also apply here; in that genus, however, it is strictly simple; in *Buxbaumia* it is double. The outer one has been already described as composed of numerous filiform cilia; these cilia do not, however, seem to be free to their base, but to be more or less laterally connected, so much so, indeed, as to form a sort of *corona*, equal in height to the inner peristome; "eminet ab inde coronæ imago, e numero-

* Greville, Wern. Trans. vol. iii. p. 445.

sissimis succulentis processubus exstructa, quos dentibus quasi adglutinatos reperi, cum horum unum alterumque de sua sede solverem." With this account given by WEBER and MOHR *, our examinations induce us to coincide, and to differ somewhat from Dr HOOKER, who, in the Flora Londinensis, seems to describe and figure them as free to the base,—a circumstance also supported by Mr BROWN, who remarks, "The peristomium of *Buxbaumia*, originating entirely from the outer membrane, may, though consisting of several, and even of dissimilar, series, be regarded as analogous to that portion of the pencil of *Dawsonia*, which arises from the same part of the capsule. This analogy is suggested by Mr HOOKER, and is confirmed by a circumstance that he does not seem to have noticed, namely, that his outer peristomium, the corona of HEDWIG, consists of a double series of cilia. The number of cilia in each series exceeds sixteen, but hardly amounts to thirty-two; it probably, however, corresponds with that of the plicæ in the membranaceous peristomium †." Though *Buxbaumia* resembles *Dawsonia* in the similarity of the origin of the cilia, the cilia themselves only resemble each other in being destitute of articulation.

BUXBAUM, in his Centuria II. p. 8, described the theca of this moss as bivalve; —"Huic insidet capitulum recurvum, ex duabus valvis compositum secundum longitudinem dehiscentibus, quarum inferior teres, superior vero magnis depressa in unquem brevem desinit." Upon this passage there is the following remark, in the Amœnitates Academicæ ‡: "Dum BUXBAUMIUS dicit capitulum findi vel secundum longitudinem dehiscere, a vero maxime deflectit;

* Handbuch, p. 382.

† Linn. Trans. vol. vol. xii. p. 582.

‡ Vol. v. p. 88.

nam tenuior illa membrana lateralis a crassiore nec finditur, nec dirumpitur; eadem ratione capitulum quoque depinxit gibbosius ad basin, quod tamen longe aliter se habet." Even Dr HOOKER seems to think that BUXBAUM mistook "a line, formed by the shrinking of the capsule, for the suture of the valves." BUXBAUM, however, was partly right; for though the theca cannot be said to be really bivalve, yet the upper portion actually separates from the lower, and falls to the ground, while the plant is undecayed. Among the specimens which the late Mr JOHN STEWART was so fortunate as to find in Selkirkshire, were many thecæ in this condition; two of these we have before us, and find that the upper membranaceous portion is completely gone*, without the least apparent laceration, and the *unruptured* sporular sac is lying in the cavity of the remaining half. This fact is extremely curious. As the mouth of the theca in this moss is so strongly fortified, and as the inner, conical, membranaceous peristome shrinks without being deciduous, and consequently closes the orifice,—may not the above apparent valvular structure be a wise provision for the more complete dispersion of the sporules?

We have already noticed that this plant is really possessed of leaves, though so minute as to escape the naked eye. Of that part on which they are found, BUXBAUM observes, "Hic, omnibus destitutus foliis, ex basi rotunda villosa," &c. In the Amœn. Academicæ the base is called "Tuberculum subovatum, vestitum tomento-ferrugineo, minime repens," &c. The curious character given by MICHELI, "Muscus nanus tuberosa radice, foliis juniperinis, tenuissime serratis capitulo magno ovato ventricoso; calyp-

* Vide Edinb. Phil. Journ. vol. ii. p. 377.

tra tomentosa*," is generally understood to have been occasioned by receiving a species of *Polytrichum* along with *Buxbaumia*. De Candolle describes it as possessing "un faisceau de poils courts et serrés au lieu de feuilles†;" and Dr Hooker, "Perichætium in terram parte immersum et radices tomentosas emittens, ovato-oblongum, bulbiforme, villis nigricantibus, brevibus, strictis, varieque intertextis obtectum‡." It would be easy to multiply quotations to prove, that whatever light this part of *Buxbaumia* was regarded, no one ever thought it was covered with true leaves. The illustrious Haller, indeed, made a near approach in saying, "Ipse, cinctus foliaceo quasi involucro, emittit durum, purpureum, pediculum ||," &c. It was reserved, however, for our countrymen, Mr Brown, and the late Mr J. Stewart, lecturer on Botany in this city, clearly to ascertain their existence, and describe their true structure. The latter gentleman noticed them particularly in his lectures on Cryptogamic Botany in the commencement of the winter of 1818–19, and read an account of them some time afterwards to the Wernerian Society§. Mr Brown also mentioned them in one of his admirable papers on Muscology, read before the Linnean Society April 6. 1819; and states, that he had "lately ascertained" their existence. In consequence of the lamented death of Mr Stewrt, it is now impossible to ascertain to whom the precedence in this discovery is due; but both assuredly are entitled to equal merit.

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* Nov. Gen. Pl. p. 109. No. 13.

† Fl. Franc. ed. 6. v. ii. p. 513.

‡ Fl. Lond.

|| Enum. Stirp. Helvet, p. 10.

§ Edin. Phil. Journ. vol. ii. p. 377. See also Edin. Encycl. art. *Musci*.

Hab. This extraordinary moss is thinly scattered through the forests and heathy parts of middle and northern Europe, but is more common in North America. Its natural habit appears to be gregarious; at the same time, and especially in this country, it sometimes loses that character. Its *duration* has usually been thought annual from the time of Linnæus to the present; Mr Stewart, however, finding plants in different and opposite stages of growth arising from the same perichætium, was induced to consider it as perennial; and we agree with him in thinking it biennial at the least *. In Britain, since its first discovery by Dr Hooker, at Sprowston, near Norwich, it has been found by Mr E. J. Maughan, at Rosslin, near Edinburgh; by Mr Jackson, near Aberdeen; by Dr Wade, at Killarney, in Ireland; by Mr J. Stewart, at Waddenshope-rig, near Peebles; and by one of the authors of the present paper, on the Hill of Dungloe, in Kinross-shire †.

Hist. The first discoverer of this singular plant, was "the modest" Buxbaum, who found it on the banks of the river Wolga, not far from Astracan, and published it in his Centuria, but without generic or specific name. He states in his description, that he felt a desire to name it after his father, but was afraid of derision; "sed venit mihi in mentem vulpes, qui deridebatur ab aliis, quod uvas non pro se, sed pro ægrota posceret matre." His character is very brief: "*Muscus capillaceus aphyllos, capitulo crasso bivalvi.*" Micheli, from specimens received from Montius, and gathered in Italy, also gave afterwards a

* Edin. Phil. Journ. vol. ii. p. 377. and Wern. Trans. vol. iii. p. 443.

† At this station, as well as the Irish one, only a single specimen has been hitherto found; and from all the other habitats it has entirely vanished, except from Mr Stewart's.

short definition, but appears to have described in it the leaves and calyptra of some *Polytrichum*. DILLENIUS, who also received specimens from MONTIUS, detected MICHELI's error, and, in the Historia Muscorum, added a few observations; but in the Appendix to that work (p. 554.), we find a much fuller notice, drawn up from the plants transmitted by OLAV. CELSIUS. HALLER, in his "Enumeratio methodica Stirpium Helvetiæ indigenarum," first bestowed on it the name of *Buxbaumia*, a name which FABRICIUS changed to *Hippopodium*, from the shape of the theca; but LINNÆUS and SCHMIEDEL restored the one given by HALLER.

So far it had been considered a moss. HALLER, however, in the first edition of his Enumeratio, mentions it as a fungus: "Character fere *Clathroidis*, planta ambigens inter id genus plantarum, et *Clavarias*. Testam habet *Clathroidis Micheliani*, et spongiosum reticulum. Sed vita perennis, et natura durior est, atque reticulum in vacuas areolas non resolvitur."—DILLENIUS, in his Appendix, seems also to doubt whether it be not a fungus: "Pro museo faciunt textura pediculorum, color eorum et capitulorum spadiceus splendens, sed præcipue opercula transversim obscedentia; fungum arguunt figura capitulorum, pulvis similior *Bovistæ*, quam farina capitulorum muscorum, et quod nec calyptra, nec folia ulla adsunt, sed basis mucida villosa. Color pediculis et capitulis erat fuscus et spadiceus, sed superficies non splendebat. Villebatur primum Musci et speciatim Lichenastri species, sed cum ex muscis crustaceis æque ac herbaceis, putrescentibus enasci observarem, Bovistam credidi. Qui nascentem videbunt, utrum fungus an muscus sit planta illa a BUXBAUMIO primum observata, decernere poterunt."—LINNÆUS, in his Species Plantarum, did not venture to arrange it among any of the well known plants; and, in the Flora Succica, it is

inserted in an Appendix, being referable by him to neither order nor genus. "Buxbaumia vero usque ad hunc diem in obscura latuit; adeo ut dum *N. D. Præses* in speciebus suis plantarum cognita, facile omnes enumeraverit plantas usque ad minimos muscos, Buxbaumia agmini illorum accedere non potuit; cumque tam scientifice et ornata plantas omnes patrias detexit atque locavit, Buxbaumia in appendice ad Floram Suecicam venire debuit plantæ instar, nec ad genus nec ordinem relatæ *."—Lastly, GLEDITSCH, in his Methodus Fungorum, mentions it, and has the following note, under the genus *Stemonitis*. "*Buxbaumia*, HALL. Enum. Helvet. p. 10, *Sphærocephalus* ejusd. p. 9, et *Clathroides* MICHELII, *N. Pl. G.* 214. tab. 94. ut conferenti patebit, charactere generico parum differunt. *Buxbaumia* igitur recte conjungantur, nec ne? et quæ sit negativæ sententiæ ratio, quæritur? *Buxbaumia* vero (Observat. HALL. docente) et *Stemonitis* in methodo nostro fungorum genera inter *Clathrum* et *Lycoperdon* media constituunt."

But of these old speculations we have already said enough. The plant has been described by HEDWIG, and all following authors, as a moss; and, with the exception of PALISSOT, who calls it *Sacophorus*, all have retained HALLER's name of *Buxbaumia*.

PLATE III.

Fig. 13. Plants of *Buxbaumia aphylla*, natural size, in different stages of growth.

14. A theca with the operculum.

15. A calyptra.

16. Operculum.

* Amœn. Acad. vol. v. p. 79.

17. The peristome and mouth of the theca; shewing the crenated margin of the theca,—the *outer* peristome composed of ciliæ (which are usually more or less injured in removing the operculum),—and the *inner* conical membranaceous peristome.
18. A mature theca divided, and exhibiting the same parts as in the corresponding figure of *Diphyscium*, the only difference being in the small pillar which supports the sporular sac and columella. It is here dilated into a little hollow globe, which nearly fills up the passage from the theca to the apophysis, and is again contracted and continued down to the base of the apophysis.
19. A sectional view of the two perichætia, the mouth of the theca, the summit of the sporular sac, and that part of the columella which is above the line at which the sporular sac is attached to it.
20. A leaf taken from near the base of the perichætium.
21. The root divided longitudinally.
22. The little pillar which supports the sporular sac removed.
23. Sporules.

All the figures, except the first, are more or less magnified.

V.—*Register of the Weather at Corfu, during the Months of August, September, October, and November*, 1821.

By Mathew Miller, Esq. Lieutenant in the King's own Light Infantry *.

(*Read 17th May* 1823.)

To Professor Jameson.

Edinburgh, 26th February 1823.

Dear Sir,

I send you inclosed the registers of the state of the weather, and of the thermometer, Adie's sympiesometer, and Leslie's hygrometer, kept by me at Corfu, during the months of August, September, October, and November, 1821. The first column, on the left, contains the days of the month, —the next, the time of observation,—the three next, the thermometer, sympiesometer, and hygrometer,—and, lastly, the observations on the wind and weather for the day.

* It is with feelings of deep sorrow we announce the sudden death of the accomplished author of this memoir. The Society, by the death of Mr Miller, loses an intelligent and active member, and the army an officer of high promise.—*Sept.* 1823.

ADIE's sympiesometer I found most useful, and, I may mention, that I always found it correspond with a mercu-barometer kept in the garrison-library, although the sympiesometer always stood about an inch higher than the mercury, consequently 30.00 must be understood to represent 29.00 by the register. LESLIE's hygrometer has explained some of the phenomena attending the Sirrocco wind, which is the SW. and SE., but more particularly the SW. winds. You will observe by the register the extreme moisture of all the south winds, and the no less remarkable dryness of the north winds.

The extreme moisture of the south winds, and the very frequent appearance of sheet-lightning during their continuance, seems to indicate their being highly electrical; and the fact, that meat will not cure, wine keep if bottled, or paint dry, during a Sirrocco, I think favours the supposition (not to speak of its very unpleasant effects on all living beings, such as are invalids particularly), that its great moisture alone could not produce all those effects. I regret having no means of making any experiments on its electrical properties, but hope on my return to do so.

I am, &c.

M. MILLER.

P. S.—I may mention that, according to the best observations, Corfu is in Lat. 39° 38′ 20″ N., and Long. 17° 55′ 50″ E.

TABLE FOR AUGUST 1821.

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
1	5 a. m.	77°	30,18	45°	Clear and sunshine all day. Wind light from NE.
	Noon.	81	30,12	65	
	3 p. m.	81½	30,13	65	
	10 p. m.	78	30,30	47	
2	5 a. m.	76	30,46	25	Light wind from the SE. Sunshine. At noon wind changed to NW. Variable at three, S.E., when, in a few minutes, the hygrometer fell to 40°.
	Noon.	81	30,40	75	
	3 p. m.	83	30,30	79	
	10 p. m.	79	30,33	39	
3	5 a. m.	76	30,46	30	Light SE. wind at ten in the morning; changed to NE.; and, about six in the evening, to SE.
	Noon.	81	30,28	39	
	3 p. m.	84	30,17	72	
	10 p. m.	79	30,15	29	
4	5 a. m	77	30,27	12	Clear and sunshine. Light S.SE. wind till ten in the morning, when it changed to SE.
	Noon.	82	30,18	50	
	3 p. m.	85	30,03	55	
	10 p. m.	80	30,12	20	
5	5 a. m.	77	30,24	5	Light S.SE. wind in the morning; changed to E. about 2 P. M. Clear and sunshine all day.
	Noon.	84	30,06	27	
	3 p. m.	86	30,02	62	
	10 p. m.	82	30,25	30	
6	5 a. m.	78	30,21	9	Clear, light S.SE. wind; changed to E. about 2 P. M.
	Noon.	88	30,05	34	
	3 p. m.	85	29,99	48	
	10 p. m.	82	30,03	15	
7	5 a. m.	78	30,07	5	Little or no wind from S.; changed to SE. about 2 p. m.; clear all day.
	Noon.	83	29,97	24	
	3 p. m.	85	29,83	35	
	10 p. m.	80	29,99	25	
8	Noon.	82	29,83	24	Wind E.SE all day. Clear and sunshine.
	3 p. m.	86	29,79	36	
	10 p. m.	81	29,99	20	
9	5 a. m.	78	30,05	8	Clear all day. Wind SE.
	Noon.	83	29,79	25	
	10 p. m.	81	29,89	26	
10	5 a. m.	78	30,08	9	Clear and sunshine. Wind SE.; changed to E. about 2 p. m.; and to S. about 6 evening.
	Noon.	84	29,91	26	
	3 p. m.	87	29,89	50	
	10 p. m.	78	30,07	15	
11	5 a. m.	77	30,09	12	Clear and sunshine. Wind SE. till 2 p. m., when it changed to W., and raised the hygrometer instantly from 28° to 53°; at 6 p. m. changed to S.
	Noon.	83	29,93	27	
	3 p. m.	86	29,85	53	
	10 p. m.	81	29,90	21	
12	5 a. m.	79	30,08	9	Clear and sunshine all day, with SE. wind in the morning, till 3 p. M., when wind changed SW.
	Noon.	84	29,91	29	
	7 p. m.	87	29,81	35	
	10 p. m.	82	29,94	11	

TABLE FOR AUGUST 1821,—*Continued.*

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
3	5 a. m.	81°	30,01	13°	Cloudy and sunshine. Wind SW. all day.
	Noon.	84	29,93	31	
	3 p. m.	85	29,84	38	
	10 p. m.	78	30,20	28	
14	5 a. m.	81	30,43	55	Morning cloudy. High wind from N; changed to NW. about 2 p. m.; rather squally.
	Noon.	82	29,96	63	
	10 p. m.	77	30,02	28	
15	9 a. m.	77	30,13	35	Clear and sunshine, with high wind from N., and a few white clouds.
	Noon.	78	30,14	38	
	3 p. m.	79	30,05	45	Very heavy rain after 2 p. m. In evening fair.
	10 p. m.	75	30,23	25	
16	9 a. m.	77	30,24	28	Morning. Sunshine, with clouds. Overcast about 10 a. m. Wind SSW.; changed to NW., with very heavy rain and thunder.
	Noon.	75	30,23	15	
	3 p. m.	74	30,23	15	
	10 p. m.	73	30,30	17	
17	9 a. m.	71	30,31	13	Rain during night. Fair after 9 in morning. Wind N. in morning; changed to NE. about 10 a. m. Cloudy at 3 p. m. High SE. wind, with rain and thunder.
	Noon.	74	30,17	25	
	3 p. m.	74	30,53	20	
	10 p. m.	72	30,19	18	
18	9 a. m.	70	30,26	14	Morning cloudy. Clear all day, with high E. wind. Began to rain about 5 p. m., and continued raining all night.
	Noon.	74	30,18	25	
	3 p. m.	75	30,11	30	
	10 p. m.	71	30,23	14	
19	9 a. m.	72	30,35	13	Wind SE. Cloudy. Partial rain. Severe storm of thunder about 3 p. m. Evening cloudy. Great deal of sheet lightning in the evening.
	Noon.	73	30,31	22	
	3 p. m.	75	30,26	17	
	10 p. m.	72	30,42	15	
20	9 p. m.	73	30,43	18	SE. wind. Clear and sunshine. A little rain and thunder at 4 p. m. Evening fine.
	Noon.	76	30,38	26	
	3 p. m.	78	30,20	27	
21	9 a. m.	76	30,51	26	Clear and sunshine. Wind NE.; changed to SE. about 4 p. m. Evening cloudy, and a good deal of sheet lightning.
	Noon.	79	30,43	52	
	3 p. m.	81	30,28	45	
	10 p. m.	77	30,47	20	
22	9 a. m.	78	30,38	25	Clear and sunshine. Wind SE.; changed about noon to NW., with a few clouds and sheet lightning in evening.
	Noon.	80	30,26	36	
	3 p. m.	81	30,15	57	
	10 p. m.	77	30,24	28	
23	9 a. m.	77	30,23	26	Clear and sunshine. Wind NW.; changed to SW. about 11 a. m., and to SE. about 2 p. m. Evening cloudy, with sheet lightning.
	Noon.	80	30,14	33	
	3 p. m.	82	30,03	41	
	10 p. m.	76	30,21	24	
24	9 a. m.	77	30,31	30	NW. wind. Clear and sunshine at 2 p. m. Wind changed to SE. Evening cloudy.
	Noon.	81	30,18	43	
	3 p. m.	83	30,20	32	
	10 p. m.	78	30,33	14	

TABLE FOR SEPTEMBER,—*Continued.*

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
25	9 a. m.	78°	30,34	21°	Sunshine. A few clouds. Wind light SW., and changed NE. about 2 p. m.
	Noon.	79	30,31	33	
	3 p. m.	80	30,26	24	
	10 p. m.	78	30,33	19	
26	9 a. m.	78	30,35	23	Morning overcast and thunder. Wind NW. Clear and sunshine from 11 a. m. till 1 p. m., when wind changed NE., with rain and thunder.
	Noon.	77	30,36	35	
	3 p. m.	76	30,36	34	
	10 p. m.	78	30,40	22	
27	9 a. m.	76	30,40	23	Clear and sunshine. Wind N. E. till noon; changed NW.; rather squally.
	Noon.	78	30,31	34	
	3 p. m.	81	30,21	53	
	10 p. m.	77	30,33	35	
28	9 a. m.	76	30,40	23	Clear and sunshine. Little or no wind from SE.; changed to NE. about 2 p. m.
	Noon.	79	30,32	27	
	3 p. m.	81	30,21	53	
	10 p. m.	77	30,33	35	
29	9 a. m.	78	30,37	21	Clear and sunshine. Light SW. wind; changed about 11 a. m. to NW.
	Noon.	80	30,31	44	
	3 p. m.	82	30,21	59	
	10 p. m.	79	30,26	25	
30	9 a. m.	78	30,37	27	Clear and sunshine. Wind SE.; changed to NW. about 1 p. m. and NE. about 2 p. m.
	Noon.	80	30,25	46	
	3 p. m.	82	30,21	65	
	10 p. m.	79	30,30	17	
31	9 a. m.	79	30,35	10	Clear and sunshine. Wind SW. all day.
	Noon.	80	30,28	29	
	3 p. m.	81	30,16	37	
	10 p. m.	79	30,12	20	

TABLE FOR SEPTEMBER 1821.

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
1	9 a. m.	80°	30,16	23°	Clear and sunshine. Wind SE. till 2 p. m., when it changed to N.NW. Rather squally at 4 p. m. Observed Hygrometer stand at 76°.
	Noon.	80	30,08	27	
	3 p. m.	82	30,02	53	
	10 p. m.	79	30,09	28	
2	9 a. m.	78	30,05	24	Morning overcast. Wind SE.; changed at 11 a. m. to NE. Squally. Wind less, and evening clear.
	Noon.	79	30,04	60	
	3 p. m.	79	30,01	45	
	10 p. m.	76	30,22	39	
3	9 a. m.	77	30,22	35	Clear and sunshine all day, with N. wind in morning, till 1 p. m., when it changed NE. Very high wind till 3 p. m.
	Noon.	78	30,14	57	
	3 p. m.	79	30,09	63	
	10 p. m.	75	30,22	39	
4	9 a. m.	75	30,30	45	Light NW. wind in morning; changed to NE. about 11 a. m. Clear and sunshine all day.
	Noon.	78	30,22	60	
	3 p. m.	74	30,17	76	
	10 p. m.	75	30,38	46	
5	9 a. m.	76	30,46	49	Clear and sunshine all day, with NE. wind. Rather squally about 3 p. m.
	Noon.	77	30,44	65	
	3 p. m.	78	30,39	72	
	10 p. m.	74	30,54	43	
6	9 a. m.	74	30,67	42	Clear and sunshine. Wind E.NE. all day.
	Noon.	77	30,57	41	
	3 p. m.	79	30,43	55	
	10 p. m.	75	30,56	39	
7	9 a. m.	76	30,53	45	Clear and sunshine. Wind N. all day; changed SE. at 6 p. m.
	Noon.	79	30,43	63	
	3 p. m.	80	30,30	77	
	10 p. m.	77	30,35	37	
8	9 a. m.	76	30,44	38	Clear and sunshine all day. Wind SW. till 2 p. m., when it changed to NW.
	Noon.	78	38,38	50	
	3 p. m.	79	30,27	74	
	10 p. m.	77	30,42	40	
9	9 a. m.	76	30,46	33	Clear and sunshine. SW. wind in morning. At 2 p. m. changed NE.
	Noon.	78	30,39	38	
	3 p. m.	79	30,35	72	
	10 p. m.				
10	9 a. m.				Thunder and rain in the morning. Wind variable from the S. Wind SE. after 2 p. m.
	Noon.	77	30,42	26	
	3 p. m.	78	30,38	30	
	10 p. m.	76	30,44	10	
11	9 a. m.	76	30,38	17	Wind S.SE. all day. Clear and sunshine all day.
	Noon.	77	30,34	30	
	3 p. m.	79	30,33	42	
	10 p. m.	75	30,35	19	

TABLE FOR SEPTEMBER 1821,—*Continued.*

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
12	9 a. m.	75°	30,35	15°	Clear and sunshine all day. Wind SE.
	Noon.	76	30,32	25	till 2 p. m., when it changed to SW.
	3 p. m.	77	30,33	36	
	10 p. m.	74	30,47	20	
13	9 a. m.	75	30,43	27	Morning overcast, and a little rain.
	Noon.	75	30,32	37	Cloudy all day. Wind SW. till 2
	3 p. m.	77	30,26	53	p. m., when it changed to N.NW.
	10 p. m.	74	30,31	21	
14	9 a. m.	75	30,04	25	Heavy rain and high SW. wind. After-
	Noon.	76	30,00	34	noon fair. Wind W. Sheet light-
	3 p. m.	75	29,99	42	ning at night.
	10 p. m.	72	30,23	18	
15	9 a. m.	69	30,41	44	Cloudy. Wind NW. about 2 p. m.;
	Noon.	70	30,39	40	changed SW. Partial rain.
	3 p. m.	70	30,44	25	
	10 p. m.	70	30,38	23	
16	9 a. m.	70	30,47	42	Wind high from N.NW.; changed SE.
	Noon.	70	30,49	23	about 10 a. m. Heavy rain all day.
	3 p. m.	71	30,52	29	
	10 p. m.	70	30,61	13	
17	9 a. m.	71	30,70	23	Clear and sunshine. Wind S.SW. till
	Noon.	71	30,64	40	11 a. m., when it changed W.
	3 p. m.	75	30,52	54	
	10 p. m.	71	30,57	29	
18	9 a. m.	72	30,48	27	Clear and sunshine. Wind S.SW. till
	Noon.	73	30,36	37	11 a. m., when it changed to W.
	3 p. m.	75	30,23	45	
	10 p. m.	72	30,31	25	
19	9 a. m.	72	30,33	26	Clear and sunshine. Wind E.SE all
	Noon.	74	30,24	40	day.
	3 p. m.	73	30,22	7	
	10 p. m.	72	30,30	23	
20	9 a. m.	73	30,26	15	Clear and sunshine. Wind SW. till 2
	Noon.	75	30,20	42	p. m., when it changed to S.
	3 p. m.	77	30,13	50	
	10 p. m.	75	30,31	13	
21	9 a. m.	75	30,49	21	
	Noon.	78	30,37	33	Clear and sunshine. Wind SE.; changed
	3 p. m.	79	30,32	56	to NW. about 2 p. m.
	10 p. m.	75	30,51	18	
22	9 a. m.	75	30,62	26	
	Noon.	76	30,58	39	Clear and sunshine. Wind W. all day.
	3 p. m.	78	30,46	47	
	10 p. m.	75	30,56	23	

TABLE FOR SEPTEMBER 1821,—*Continued.*

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
		°		°	
23	9 a. m.	74	30,53	17	Cloudy. Wind S.SE. all day.
	Noon.	76	30,57	33	
	3 p. m.	78	30,43	37	
	10 p. m.	75	30,56	16	
24	Noon.	77	30,53	24	Cloudy. Wind S.SW.; changed at 11 a. m. to W.
	3 p. m.	78	30,43	40	
	10 p. m.	75	30,50	27	
25	9 a. m.	75	30,54	33	Cloudy. Wind S.; changed at 11 a. m. to NW., with violent rain and thunder. Fair at 3 p. m.
	Noon.	76	30,53	34	
	3 p. m.	74	30,54	7	
	10 p. m.	73	30,58	8	
26	9 a. m.	73	30,57	17	Clear. Wind SE. all day. Sheet lightning in the evening.
	Noon.	73	30,54	25	
	3 p. m.	75	30,44	42	
	10 p. m.	74	30,52	14	
27	9 a. m.	73	30,51	21	Clear in morning. Wind S.; changed to a high N.NW. wind about 2 p. m. Evening cloudy.
	Noon.	74	30,46	31	
	3 p. m.	74	30,39	65	
	10 p. m.	72	30,53	42	
28	9 a. m.	71	30,60	39	Clear and sunshine all day, with high N.NW. wind.
	Noon.	70	30,60	57	
	3 p. m.	73	30,50	67	
	10 p. m.	70	30,65	33	
29	9 a. m.	71	30,75	38	Rather cloudy. Wind NW. in morning; changed to S.SE about 2 p. m.
	Noon.	72	30,67	40	
	3 p. m.	71	30,61	27	
30	9 a. m.	71	30,49	27	Cloudy all day. Wind SE. Partial rain. High wind and great deal of sheet lightning at night.
	Noon.	72	30,67	40	
	3 p. m.	72	30,32	18	
	10 p. m.	72	30,17	11	

TABLE FOR OCTOBER 1821.

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
1	9 a. m.	68°	30,33	36°	Rain in morning. Wind NE.; variable. Fair and clear after 10 a. m. This morning, a most violent storm of thunder.
	Noon.	68	30,45	44	
	3 p. m.	67	30,56	34	
	10 p. m.	64	30,67	24	
2	9 a. m.	65	30,75	22	Rained all day. Wind high from NNW.
	Noon.	66	30,72	45	
	3 p. m.	66	30,68	55	
	10 p. m.	65	30,79	25	
3	9 a. m.	67	30,83	33	Clear and sunshine. Wind ENE. till 2 p. m., when it blew hard from NNE.
	Noon.	67	30,79	39	
	3 p. m.	69	30,70	65	
	10 p. m.	66	30,81	44	
4	9 a. m	67	30,82	52	Clear and sunshine. High NNE. wind all day.
	Noon.	69	30,70	78	
	3 p. m.	70	30,61	80	
	10 p. m.	67	30,65	51	
5	9 a. m.	67	30,69	31	Clear and sunshine. Wind NE. all day.
	Noon.	68	30,67	52	
	3 p. m.	69	30,59	65	
	10 p. m.	65	30,70	34	
6	9 a. m.	65	30,90	34	Clear and sunshine. Light S.SE. wind all day.
	Noon.	68	30,76	39	
	3 p. m.	69	30,80	44	
	10 p. m.	67	30,99	30	
7	9 a. m.	68	31,10	23	Clear and sunshine. Light SSE. wind till 2 p. m., when it changed to N.NW.
	Noon.	69	31,03	40	
	3 p. m.	71	31,00	49	
	10 p. m.	68	31,07	18	
8	9 a. m.	68	31,03	22	Clear and sunshine, with S.SE. wind till 2 p. m., when it changed to E.
	Noon.	70	30,96	35	
	3 p. m.	71	30,83	42	
	10 p. m.	67	30,86	28	
9	9 a. m.	67	30,88	19	Morning clear. Overcast during the day, with S.SE. wind till 2 p. m., when it changed to N.NW.
	Noon.	70	30,86	36	
	3 p. m.	72	30,72	60	
	10 p. m.	68	30,94	13	
10	9 a. m.	69	30,93	25	Clear and sunshine. Wind E.SE. all day. Rather squally in the afternoon.
	Noon.	70	30,88	42	
	3 p. m.	71	30,74	63	
	10 p. m.	68	30,75	34	
11	9 a. m.	68	30,80	43	Morning cloudy. Wind SE.; changed to S. about noon; blew hard; and rained all day from 2 p. m.
	Noon.	69	30,82	42	
	3 p. m.	69	30,69	25	
	10 p. m.	67	30,79	17	

TABLE FOR OCTOBER 1821,—*Continued.*

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
12	9 a. m.	67°	30,96	11°	Thunder in morning, and heavy rain from 7 a. m. till 1 p. m. Wind E. and W.; variable.
	Noon.	66	30,96	13	
	3 p. m.	70	30,79	25	
	10 p. m.	69	30,86	23	
13	9 a. m.	70	30,88	28	Clear and sunshine all day. Wind S.SE. all day.
	Noon.	71	30,84	27	
	3 p. m.	72	30,82	30	
	10 p. m.	69	30,91	7	
14	9 a. m.	69	30,94	12	Clear and sunshine. Wind light S. E. all day.
	Noon.	70	30,86	26	
	3 p. m.	71	30,81	23	
	10 p. m.	68	30,86	14	
15	9 a. m.	69	30,84	18	Clear and sunshine. Wind SE. all day.
	Noon.	69	30,77	29	
	3 p. m.	70	30,70	27	
	10 p m.	67	30,68	12	
16	9 a. m.	66	30,64	27	Rain in morning. Fair and clear from 10 a. m. Wind variable from SE. all day.
	Noon.	68	30,62	37	
	3 p. m.	69	30,50	38	
	10 p. m.	68	30,47	36	
17	9 a. m.	70	30,40	27	Rained all day. Wind S.; variable.
	Noon.	70	30,42	27	
	3 p. m.	68	30,50	9	
	10 p. m.	64	30,54	6	
18	9 a. m.	68	30,63	16	Clear and sunshine. Wind S. till 2 p. m. when it changed to N.NW.
	Noon.	69	30,61	23	
	3 p. m.	70	30,57	42	
	10 p. m.	62	30,56	19	
19	9 a. m.	63	30,57	22	Wind E.; variable. Rained all day, with thunder.
	Noon.	64	30,56	19	
	3 p. m.	64	30,48	10	
	10 p. m.	63	30,45	5	
20	9 a. m.	65	30,45	16	Morning fair. Rained all afternoon. Wind S.SE.
	Noon.	67	30,40	25	
	3 p. m.	66	30,46	15	
	10 p. m.	63	30,45	17	
21	9 a. m.	62	30,52	15	Rain in morning, with S. wind; changed at 2 p. m. to E.NE., with high wind and rain.
	Noon.	63	30,50	20	
	3 p. m.	64	30,53	12	
	10 p. m.	62	30,60	10	
22	9 a. m.	66	30,79	18	Wind S. all day, with rain and thunder.
	Noon.	68	30,71	21	
	3 p. m.	67	30,72	15	
	10 p. m.	66	30,78	20	

TABLE FOR OCTOBER 1821,—*Continued.*

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
		°		°	
23	9 a. m.	66	30,69		Wind S. Morning rain. 2 p. m. wind
	Noon.	66	30,64	22	changed to S.SE.; blew most violent-
	3 p. m.	67	30,57	37	ly. At half past 5 p. m. felt the
	10 p. m.	64	30,62	12	shock of an earthquake.
24	9 a. m.	63	30,78	13	Rain in morning. Clear and sunshine
	Noon.	64	30,81	22	all day. Wind E.
	3 p. m.	65	30,80	18	
	10 p. m.	63	30,84	11	
25	9 a. m.	64	30,75	18	Morning cloudy. Partial rain. Wind
	Noon.	65	30,65	25	S.SW. all day. Violent thunder storm
	3 p. m.	64	30,66	20	and heavy rain at 7 p. m.
	10 p. m.	63	30,64	10	
26	9 a. m.	63	30,51	20	Wind SE. Partial rain and thunder in
	Noon.	63	30,53	15	the evening.
	3 p. m.	64	30,45	22	
	10 p. m.	64	30,53	19	
27	Noon.	66	30,54	30	Clear and sunshine. Wind NE. all
	3 p. m.	65	30,57	47	day.
	10 p. m.	64	30,83	37	
28	9 a. m.	64	31,02	28	Cloudy. Wind E. A little rain in
	Noon.	65	31,01	31	the evening.
	3 p. m.	65	31,04	42	
	10 p. m.	64	31,16	20	
29	9 a. m.	65	31,12	26	Wind SE. Clear and sunshine till 5
	Noon.	65	31,01	33	p. m., when it rained.
	3 p. m.	64	31,06	27	
	10 p. m.	63	31,00	24	
30	9 a. m.	62	30,94	20	Clear and sunshine. Wind E. by S. till
	Noon.	64	30,98	36	sunset, when it changed to N.NE.
	3 p. m.	65	30,83	35	
	10 p. m.	63	30,92	54	
31	9 a. m.	61	31,06	53	Clear and sunshine. Wind N.NE. till
	Noon.	62	31,08	51	sunset, when it changed to SE.
	3 p. m.	64	31,03	64	
	10 p. m.	62	31,17	24	

TABLE FOR NOVEMBER 1821.

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
1	9 a. m.	61°	31,28	26°	Clear and sunshine. Wind E. and NE. all day.
	Noon.	62	31,28	34	
	3 p. m.	63	31,25	45	
	10 p. m.	61	31,86	18	
2	9 a. m.	61	30,72	19	Clear and sunshine. Wind SW. till 2 p. m., when it changed to NE. Evening cloudy, with a good deal of thunder.
	Noon.	62	30.75	26	
	3 p. m.	63	30,84	40	
	10 p. m.	60	30,41	17	
3	9 a. m.	61	30,33	13	Clear and sunshine. Wind SW, but very little of it.
	Noon.	62	30,33	23	
	3 p. m.	64	30,41	26	
	10 p. m.	62	30,13	10	
4	9 a. m.	61	29,96	9	Clear and sunshine all day. Wind SE.
	Noon.	64	30,07	12	
	3 p. m.	64	30,04	14	
	10 p. m.	62	29,90	12	
5	9 a. m.	61	29,82	14	Wind SE. Cloudy, and a good deal of rain.
	Noon.	65	29,80	14	
	3 p. m.	65	29,74	8	
	10 p. m.	63	29,60	11	
6	9 a. m.	63	29,54	7	Cloudy, and very heavy rain, with thunder and high NE. wind.
	Noon.	64	29,48	25	
	3 p. m.	64	29,47	27	
	10 p. m.	60	29,30	15	
7	9 a. m.	60	29,09	16	Wind SW. in morning; changed to E. about 2 p. m. Cloudy, and partial rain all day, with the wind very high.
	Noon.	62	29,14	19	
	3 p. m.	63	29,10	27	
	10 p. m.	59	28,99	25	
8	9 a. m.	57	28,96	23	Cloudy, with NE. wind; changed to high E. wind about 2 p. m.
	Noon.	61	28,88	30	
	3 p. m.	62	28,90	26	
	10 p. m.	59	28,83	28	
9	9 a. m.	58	28,82	20	Clear and sunshine. Wind NE. all day.
	Noon.	62	28,88	44	
	3 p. m.	62	28,87	39	
	10 p. m.	58	28,75	30	
10	9 a. m.	60	28,75	34	Clear and sunshine. Wind NE. till 3 p. m., when it changed to E. Blew rather hard in the evening.
	Noon.	61	28,78	41	
	3 p. m.	59	28,75	43	
	10 p. m.	55	31,41	49	
11	9 a. m.	53	31,46	21	Clear and sunshine. Wind E., blowing hard all day.
	Noon.	59	31,44	44	
	3 p. m.	60	31,49	48	
	10 p. m.	49	31,45	27	

TABLE FOR NOVEMBER 1821,—*Continued.*

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
12	9 a. m.	54°	31,54	32°	Clear and sunshine. Wind E. all day.
	Noon.	58	31,46	40	
	3 p. m.	60	31,49	42	
	10 p. m.	49	31,45	27	
13	9 a. m.	57	31,63	32	Clear and sunshine. Wind E. all day.
	Noon.	59	31,67	37	
	3 p. m.	58	31,64	40	
	10 p. m.	56	31,59	22	
14	9 a. m.	58	31,63	23	Clear and sunshine. Wind E. all day.
	Noon.	60	31,50	28	
	3 p. m.	59	31,53	22	
	10 p. m.	51	31,55	10	
15	9 a. m.	56	31,68	6	Clear and sunshine. Wind SE. ; variable all day.
	Noon.	60	31,57	23	
	3 p. m.	59	31,51	24	
	10 p. m.	57	31,57	19	
16	9 a. m.	58	31,53	10	Wind SE. Rained all day till 4 p. m. Wind changed to NE. about 1 p. m.
	Noon.	60	31,52	19	
	3 p. m.	58	31,53	13	
	10 p. m.	53	31,53	7	
17	9 a. m.	51	31,62	3	Clear and sunshine. Wind SE. all day.
	Noon.	58	31,63	27	
	3 p. m.	58	31,59	25	
	10 p. m.	53	31,70	8	
18	9 a. m.	55	31,80	5	Light SE. wind all day. Clear and sunshine.
	Noon.	58	31,70	15	
	3 p. m.	59	31,68	25	
	10 p. m.	55	31,64	12	
19	9 a. m.	57	31,58	7	Cloudy. Partial rain. Wind SW.
	Noon.	60	31,50	20	
	3 p. m.	61	31,43	25	
	10 p. m.	55	31,49	11	
20	9 a. m.	56	31,54	4	Light SE. wind. Clear and sunshine all day.
	Noon.	60	31,50	20	
	3 p. m.	61	31,40	26	
	10 p. m.	54	31,41	7	
21	9 a. m.	58	31,46	6	Clear and sunshine. Light wind from S.SE. all day.
	Noon.	60	31,39	20	
	3 p. m.	62	31,33	25	
	10 p. m.	58	31,36	16	
22	9 a. m.	50	31,17	21	Clear and sunshine. High S.SE. wind all day.
	Noon.	62	31,35	23	
	3 p. m.	62	31,31	26	
	10 p. m.	62	31,30	20	

TABLE FOR NOVEMBER 1821,—*Continued.*

DAY.	TIME.	THERMOMETER.	SYMPIESOMETER.	LESLIE'S HYGROMETER.	OBSERVATIONS.
		°		°	
23	9 a. m.	60	31,18	17	Wind SE. Clear and sunshine all day.
	Noon.	64	31,16	22	
	3 p. m.	64	31,12	25	
	10 p. m.	58	31,14	13	
24	9 a. m.	60	31,10	17	Wind SE. Clear and sunshine all day.
	Noon.	63	31,10	25	
	3 p. m.	61	31,22	15	
	10 p. m.	62	31,18	13	
25	9 a. m.	60	31,14	9	Morning rainy. Wind changed from SW. to NE. at 4 p. m.
	Noon.	60	31,11	11	
	3 p. m.	63	31,06	22	
	10 p. m.	61	31,08	26	
26	9 a. m.	59	31,23	4	Clear and sunshine. Wind SE. all day.
	Noon.	60	31,28	14	
	3 p. m.	63	31,18	29	
	10 p. m.	60	31,10	13	
27	9 a. m.	61	31,14	15	Clear and sunshine. Wind changed from E. to SE. about 10 a. m.
	Noon.	61	31,10	22	
	3 p. m.	63	31,16	18	
	10 p. m.	60	31,15	14	
28	9 a. m.	61	31,18	12	Wind SE. Clear and sunshine all day.
	Noon.	62	31,15	20	
	3 p. m.	63	31,12	23	
	10 p. m.	58	31,11	14	

PLATE IV.

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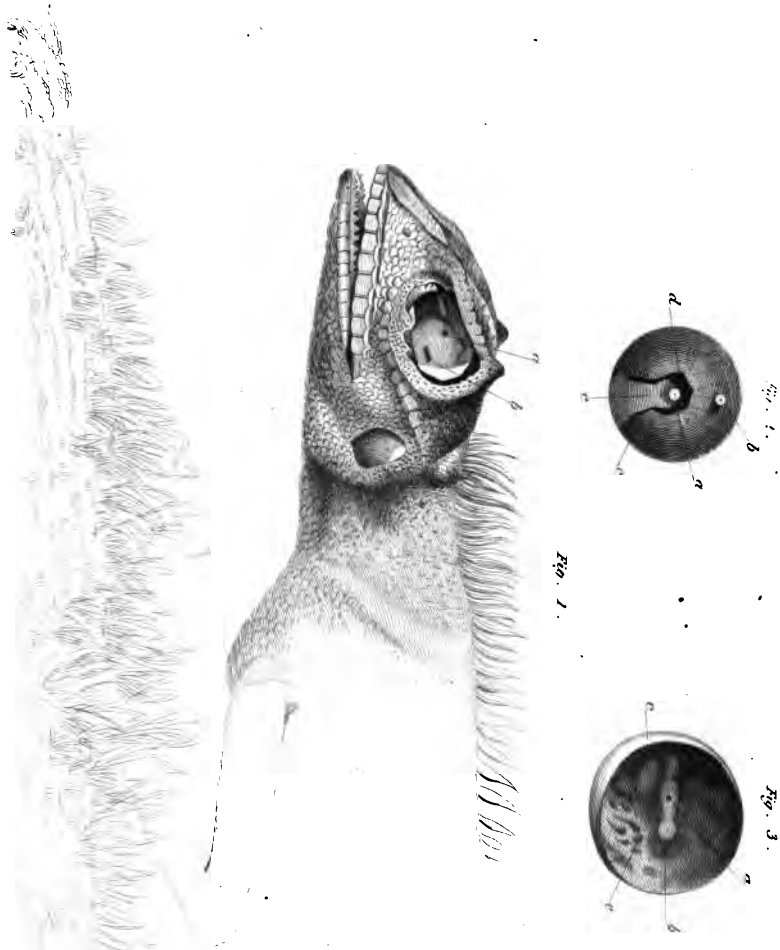

Fig. 1.

Fig. 2.

Fig. 3.

Lizars sculpt.

is caused by a remarkable thinness of the retina at this point. The retina around the *foramen* has adhering to it a quantity of black granulated matter, which it probably receives from the choroid.

Exactly at the point corresponding to the *foramen*, the choroid is somewhat elevated internally, whilst it transmits externally a dark-coloured membranous canal or tube to the sclerotic. This is the only point at which I have found the choroid adhering to the sclerotic in these animals.

Nothing novel is shewn by examining the *foramen centrale* under the microscope, but the structure is naturally rendered more distinct. We perceive that the *foramen* is not quite circular, but somewhat irregular in its margin, and that the actual aperture is smaller than might be otherwise supposed. This diminution in the real size of the aperture is owing to a thin semitransparent layer, proceeding from the more solid and opaque retina towards the centre of the aperture. I hope soon to be able to submit to the Society some further researches on this subject.

I ought perhaps to have added, that most of the dissections detailed in this and in my former paper announcing the discovery, were performed in the presence of numerous friends; most of the preparations are in my possession, and will be deposited in the Museum; but I have reserved a few specimens, lest any of the members of the Society, accustomed to minute research, should desire to examine the structure for themselves.

Explanation of Plate IV.

Fig. 1. Represents the head of a variety of the *Lacerta superciliosa*. The eye was dissected *in situ*; the whole dissection consists in snipping off with a pair of

very sharp scissars the anterior third of the eye-ball, including the cornea and iris: the lens and capsule of the vitreous humour must now be very carefully removed with a fine brush. I have thought it worth while to mention the mode I adopt in displaying the retina, because, by its adoption, any one, whether anatomist or not, will readily ascertain the presence or absence of this very extraordinary structure.

The black point *b*, marking the entrance of the optic nerve into the interior of the eye-ball, may readily be distinguished from the *foramen centrale* (*a*), by the little marsupium which has been left attached to the former. I regret that the drawing had not been taken from the eye of the chameleon, in which the structure is naturally so greatly magnified.

Fig. 2. The eye-ball viewed posteriorly, to shew that the transparent Point of Sœmmering is really a *foramen*. The sclerotic *c*, and choroid *d*, have been removed, leaving the retina (marked *e*), in which the *foramen* (*a*) is distinctly visible. *b*, marks the entrance of the optic nerve.

Fig. 3. The *foramen centrale*, fold, and yellow spot, as seen in the eye of apes. This latter figure is of the natural size; the others are somewhat magnified. The letters refer to the same parts as in the former figures.

EDINBURGH,
Sept. 1. 1823.

VII.—*Contribution to a Natural and Economical History of the Coco-Nut Tree.*

By Mr Henry Marshall,
Surgeon to the Forces, and Author of Notes on the Medical Topography and Diseases of the Interior of Ceylon.

(*Read 22d November* 1823.)

THE Coco-nut tree (*Cocos nucifera*) belongs to the class Moncecia, order Hexandria, of the Linnean classification of plants.

Stem erect, without branches, from 60 to 90 feet in height, and from one to two feet in thickness. It is marked with parallel rings from the cicatrices of the fallen leaves, about two of which separate annually. By these cicatrices or marks the age of a tree is ascertained.

The stem is crowned with a bunch of about twelve or fifteen fronds (palm-leaves), each twelve or fourteen feet long, and composed of a double row of opposite sword-shaped leaflets, in length from three to four feet; upper leaves are erect, middle horizontal, lower ones rather drooping. A single leaf closely resembles a greatly magnified ostrich-feather.

The flower is axillary, and proceeds from a large single-leaved pointed spathe, which always opens on the under surface. The spadix is spicate; each spike has towards its base one or two female flowers, the others being male. In both male and female flowers the calyx has three divisions, and the corolla three petals. The male flowers have six stamens, and the female three stigmas. Drupe oval, three-sided, about from eight to ten inches long, exterior covering smooth, interior fibrous; nut monospermous, very hard, has three unequal holes at the base closed with a black membrane; medullary part nearly half an inch thick, white, hard, commonly filled with a sweetish watery liquid. Ripe nuts are known by a succussion of the water they contain, when shaken.

A reticulated substance, resembling coarse cloth, involves the base of each leaf; it falls off before the leaf has attained a state of maturity. In Bengal, this filamentous body is supposed to harbour insects, which are destructive to the tree: on that account, it is there destroyed by fire.

The roots are slender, and very flexible: they rise separately from the bottom of the trunk, some sinking deep in the earth, while others take a horizontal direction very little under the surface. They do not penetrate an indurated soil.

The young tree bears a near resemblance to a herbaceous plant; indeed, during the whole progress of its growth it has some analogy with vegetable productions of this kind. The stalk of some species of Brassica (or Cabbage genus) consists chiefly of pith, until the plant attains a certain age, when the exterior crust of the trunk becomes ligneous, and the proportion of pith diminishes. In several respects the Coco-nut tree has a similar progress. It has no brak; the surface appears to be formed of the cicatrices, which succeed the fall of the leaves, much hardened by the

action of the air and sun. A slight wound in the central bud is fatal to the tree; but the hardened trunk is capable of bearing considerable injury with impunity.

Coco-nut trees are often struck by lightning, which frequently kills the terminal leaf-bud, and thereby occasions the death of the tree. This tree never changes the diameter it has once acquired. Should any circumstance occur capable of retarding the growth during one or more years, such as transplantation, the effect is very evident in the stem by a permanent contraction in its diameter. Immediately above these strangulated parts small roots sometimes protrude, but they seldom extend beyond a few inches. Frequently the trunk has a larger diameter at the base and top than in the middle.

The wood of the stem is composed of hard, flexible, ligneous, black fibres, united by a soft brownish pith, or cellular substance, capable of being reduced to powder. "The palms have in the interior structure of their trunks no analogy with other trees. In habit and in structure they resemble the ferns, in their blossom the grasses, and the asparagi in their mode of fructification *." All the palms have in a greater or less degree a spongy structure. The cellular substance of the *Cycas circinalis* (Sago-palm) is, in some of the islands of the eastern Archipelago, manufactured into the nutritive substance called Sago. The *Caryota urens* (Nepery tree) yields a considerable quantity of fecula, or sago; but in Ceylon this substance is not extracted, except during a period when rice is scarce. Sago is easily obtained from the interior part of the trunk of these trees. The process consists in pounding the spongy or cellular texture of the stem, and washing it with water, which is strained, to separate the ligneous fibres from the feculent

* Malte Brun.

substance. The process of granulating sago is not practised in Ceylon. The exterior lamina and base of the stem of a Coco-nut tree is always much harder than the interior and upper portion.

There is a palm called the King's Coco-nut, the fruit of which has a bright yellow colour, but it does not appear to be a different species from the *Cocos nucifera*. Nuts of this kind contain a great proportion of fluid, which, on account of its supposed cooling quality, is given to invalids, in preference to that of the common nuts; but they are not esteemed so good as common nuts for culinary purposes.

The nut known by the name of the Maldive Coco-nut, Coco de Mer, Zee-calappers, *Tavarcarse*, Sea Coco-nut, Double Coco-nut, Nux medica (*Borassus Sechellensis*), is the produce of a palm-tree, which ROCHON tells us abounds in the Isle of Palms, one of the Seychelle Islands, but no where else. The fruit presents an appearance of two thighs; in other respects it is not materially different from the common coco-nut. The nuts which are occasionally found at the Maldive Islands have been carried by the current from the above-named Island.

When the Maldive traders arrive at the ports of Galle or Colombo, in Ceylon, which they usually do once a year, it is customary for them to make a present to the governor of the island, or the commanding officer of the garrison, in a very formal manner. On this occasion, I have known a small portion of the kernel of one of these nuts form part of the donation; from which it may be inferred that they imagine it to be an article of some value.

Great medicinal virtues are ascribed to this nut by the Indians, both in the prevention and cure of diseases. The venereal disease is supposed to be radically cured by it. THUNBERG says, it is deemed a sovereign remedy against

the flux, the epilepsy, and apoplexy. ROCHON tells us that it was not uncommon at one time to see them sold for upwards of L. 400 sterling each. The Emperor RODOLPHUS the Second could not procure one at the price of 4000 florins. Some of the wealthy Indians had cups made of them, which they ornamented with gold and precious stones. They are now more generally diffused than formerly, and consequently much less valuable. MALTE BRUN informs us that it has been found profitable to cultivate them in the Isle of France. Many of the mendicants in Ceylon have nuts of this kind, in which they put the provisions they receive in alms *.

The Coco-nut tree, both in regard to the variety and utility of its products, is the most interesting of the palm tribe, " the princes of the vegetable kingdom."

The tree sometimes bears fruit in five or six years from the time it is transplanted from the seed-bed, but the produce is rarely abundant before the eighth or ninth year. It continues to yield fruit for sixty or seventy years. In good soils, and particularly during wet seasons, the tree blossoms every four or five weeks; hence there are generally fresh flowers and ripe nuts on the tree at the same time. There are commonly from five to fifteen nuts in a bunch; and, in good soils, a tree may produce from eight to twelve bunches, or from 80 to 100 nuts annually.

Coco-nut trees are sometimes much injured by various species of Scarabeus, particularly the *Scarabeus rhinoceros*. They excavate a hole of about an inch diameter in the terminal leaf-bud, and, when the leaves expand, the leaflets appear full of holes, as if they had been battered with shot of different sizes. In consequence of the injury done to the bud by this insect, the trees are sometimes killed.

* System of Geography by MALTE BRUN, vol. iv. p. 420. THUNBERG's Travels, vol. iv. p. 209.

This species of the Palm family has its habitat in inter-tropical Asia, Australia, America, and Africa. It is by some authors said to have in ancient times been cultivated in Arabia, but NIEBUHR informs us that it is not found to the north of Mocha. Like all other equinoctial plants, the Coco-nut tree becomes less luxuriant as we approach the Tropics. At the suggestion of Mr DUNLOP, who lately, in so able a manner, superintended the work now in progress, to clear Saugur Island, at the estuary of the Hooghly, that den of tigers is likely soon to be a continued grove of coco trees. Saugur lies in N. Lat. 21° 30′, which is perhaps as far from the Equinoctial Line as this species of palm can be cultivated with advantage. In the neighbourhood of Lucknow, which lies in N. Lat. 26° 24′, the Coco-nut tree grows, but it does not produce fruit. I am informed by Dr BUCHAN, Deputy-inspector of Hospitals, who was for some time on duty in Egypt, that it is not found in that part of Africa. As the Coco tree seems to require for its perfection a mean temperature of not less than 72° FAHRENHEIT, the proper climate for it will therefore be from the Equator to the 25th parallel of latitude, and in the Equinoctial Zone to an altitude of about 2900 feet. This general statement will no doubt admit of some qualification in regard to particular situations. There may be exposed spots within its favourite climate where the fruit will not come to maturity, and warm valleys beyond the above limits where the tree will grow, and perhaps produce ripe nuts. The Coco tree occupies, therefore, a zone of 25° of latitude on both sides of the Equator, which includes nearly four-fifths of Africa, one-sixth of Asia, one-third of America, and excludes Europe. It may be remarked, that trees which grow on the immediate neighbourhood of the sea are much more luxuriant and productive than those which are planted inland or upon elevated situations. The cause of this

degeneration is not very evident, it cannot invariably be attributed to a reduction of temperature. The Coco tree is much cultivated on some parts of the east coast of America; from the river St Francisco to the Bar of Mamanguape, or from about 7° 30′ to 10° S. Lat., being about 94 leagues, the Brazilian coast is with few breaks planted with Coco trees. The small island of Itamaraca, which is only three leagues in length, yields annually about 360,000 nuts *. But perhaps this palm is no where so extensively cultivated as in Ceylon, and the following remarks regarding its products are intended more immediately to apply to the tree as it grows in that island. The Coco tree is cultivated both in the interior of Ceylon and along the flat country adjoining to the sea; it thrives best, however, on the coast of the south-west aspect of the island, or from Calpenteen on the north, to Dondrahead on the south. About the year 1813, it was estimated that 10,000,000 trees grew between these two points, and that since that period the number has been annually increasing. The extent of coast between Dondrahead and Calpenteen is about 184 miles; the whole circuit of the island is 754 miles. Except cinnamon, the products of the Coco tree form the chief staple commodities of Ceylon †. The Maldive Islands produce great quantities of coco-nuts; they are there said to be the price of labour. In Congo, this palm forms one of the greatest blessings in nature ‡.

* Koster's Description of Brazil.

† I have attempted to detail the leading facts regarding the natural history of the Cinnamon tree, the mode of preparation, and trade of Cinnamon, in two papers, one of which is published in the Transactions of the Royal Society of London, for the year 1817. The other is inserted in the 10th volume of Dr Thomson's Annals of Philosophy.

‡ System of Geography, by Malte Brun, vol. iv. p. 298.

It does not appear that the coco-tree is nearly as much cultivated in the West India islands as in the East. Mr Stewart, in his account of Jamaica, says, however, that "On some estates groves of them are planted, and an oil extracted from them to light the works during crop-time. Occasionally the nuts are served out to the slaves as an article of food."

In many places along the coast coco trees thrive well upon the sandy soil near to the sea, where hardly any other plant will vegetate. Those coco groves, through which the eye can reach for a great extent, intermixed with the huts of the natives, composed entirely of coco leaves, form a very picturesque object. When the trees are full grown, the bare trunks rise like columns of from 60 to 90 feet in height, while the horizontal pinnated foliage interlace, by which means a grove resembles the long aisles and Gothic arches of a cathedral; above these arches a profusion of fine leafy plumes rise from the centre of the trees, and project almost perpendicularly towards the sky, thereby adding greatly to the beauty and variety of the prospect. About twenty years since, the Colonial Government of Ceylon had it in contemplation to impose a tax upon coco trees, but, in consequence of the strongly marked aversion of the people to such a measure, the plan was abandoned. It is not unusual, however, for palm trees to be taxed directly, instead of indirectly, upon the products, as in Ceylon. On the Malabar coast, coco-nuts pay a land-tax of half a *fanam* for every tree that is in full bearing, old and young trees being exempted as unproductive. And, at Marzouck, in northern Africa, a tax of one dollar is levied upon every 200 date-trees*.

* Buchanan's Travels through Mysore, &c. vol. ii. p. 401. Lyon's Travels in Africa.

The cottages of the inhabitants are always surrounded by a great number of palm-trees, more particularly of the coco-nut palm; and those plants seem to thrive best which are situated near to the dwellings of the inhabitants. This circumstance has given rise to an observation of the natives, namely, that a coco-nut tree delights in conversation. The ashes which result from the burning of wood, for culinary purposes, is a more probable cause of the luxuriance of the trees close to the cottages, as the sweepings of the huts are generally deposited at the foot of a tree. The cluster of trees which surrounds a hut is called a "Toddy tope" by the English. *Tope* is perhaps a corruption of our word *copse*. *Watte*, a Singhalese word, is used to designate every description of plantation. *Pol-watte* signifies a coco-nut garden or plantation. I have already stated that the Singhalese almost always construct their huts under the dense shadow of palm-trees of different kinds. This comfortable mode of defending habitations from the direct influence of an ardent sun, seems to have in ancient times been practised in Judea (Judges, iv. 5.), and it is very generally adopted in all countries where the palm family is found to thrive.

SYNONYMES.

Nari Kaylum Tangadra, -	Sanscrit.
Polgaha, - - -	Singhalese.
Palma Indica coccifera angulosa,	Burman. Zeyl.
Calappa Palma indica major,	Rumph. amb.
Tenga, - - -	Rheede.
Taygana, - - -	Canarese.
Tenkay, Narica, Kabari, -	Telinga.
Cagolli, - - -	Mexican.
Masogua Inaiguaruiba, - -	Brasillian.
Cây Dua, - - -	Cochin Chinese.
Yâi Yé, - - -	Chinese.
Cocos Palma, - - -	Loureiro.
Cocotier or *Cocos*, - -	Labat.
Coco or *Coco-nut tree*, - -	English.

When very young, the fruit is called *Bellaca* by the inhabitants of the Malabar Coast, who speak the Tamool language, and *Coquinhas* by the Portuguese; Singhalese, *Kooroomba*. When fully formed, but with a soft pulp, it is called *Elani* by the Tamools, in Portuguese *Lania*. When a little firmer, it is called *Tenga* in the Tamool language, and *Coquo* in the Portuguese. The mature nut is called *Cotta tenga* by the Malabars, and *Coquo sicco* by the Portuguese. In the Singhalese language, the nut is called *Pol*. The term Coco, by which this palm and its fruit is distinguished, is said by several authors to be of Portuguese origin. BAUHIN tells us, that *Coco*, or *Coquen*, is derived from the three holes at the end of the nut, giving it the resemblance of a Cercopithecus, a species of monkey. St PIERRE, in his Harmonies of Nature, says, that a coco-nut, stripped of its pericarp, bears an exact resemblance to the head of a negro. PISO asserts, that the term Coco has been applied to the tree, on account of the sound emitted, when air is blown into one of the holes of the nut, having a resemblance to the voice of an ape. The Portuguese name for a monkey is *macaco*, or *macoco*. There is, however, better foundation for supposing that Coco is derived from the Greek word κοκκος, *a seed*, or *berry*.

USES.

Roots.—This part of the tree is sometimes masticated by the natives in place of the areca-nut. The Brazilians make baskets of the small roots.

The hard woody shell or crust of the trunk is employed by the natives in making drums, and in the construction of their huts, &c. It is also much employed for making gutters. Towards the base of the trunk the wood is remarkably hard, and admits of a high polish. A transverse section of this part of the tree, when well polished and var-

nished, has a lapideous gloss and beauty, which rival those of an agate. I have seen a polished portion of the wood set in the lid of a silver snuff-box, in the same manner as jewellers occasionally fix agates or cornelians. It might, I think, be found highly useful in ornamental cabinet-work.

In some parts of the world, I am informed that a kind of cradle or couch for young infants is made of the reticulated substance formed at the base of the leaf. I never saw it applied to this purpose in Ceylon; it is there chiefly employed as an instrument of filtration, for straining the sweet juice which is extracted from the flowering spath of this tree. The Reverend J. CORDINER asserts, that it "is manufactured into a durable sackcloth, called *gunny*, which is used in making bags for transporting grain," &c.; and Captain PERCIVAL says, that it is manufactured into a coarse cloth called *grinjakken* (I presume he means *ganja sakken*) or gunny-cloth. If I mistake not, their statements are erroneous; gunny-cloth is made of hemp. Gunny or Goni is not improbably a corruption of ganja, the Hindostanee name of the hemp-plant (*Cannabis sativa*). According to BUCHANAN, goni-cloth is made from the *Janupa* (*Crotolaria juncea*) *. Sacks made of goni-cloth, are in India called *gunny-bags* by the English, and *ganja sakken* by the Dutch.

The unexpanded leaves or terminal leaf-bud is occasionally eaten by the Europeans as well as by natives. When boiled it is tender, and forms a good substitute for cabbage. The natives sometimes preserve it in vinegar, and eat it as a pickle. It may be observed, that the tree dies when this part is removed.

Many of the indigenous inhabitants, as well as natives of

* Journey through Mysore, &c., vol. i. p. 226.

Europe, thatch their houses with coco-nut leaves, in the Singhalese language called *polattu*. Sometimes they are denominated *ollahs*, and at other times *cadjans*. The latter term has, I believe, a Malay origin. To prepare *cadjans*, the central ligneous portion of the leaf is divided longitudinally, the leaflets of each half are then plaited or interwoven, by which means they are adapted for a variety of uses. In this state they are employed to thatch cottages, to shelter young plants from the scorching rays of the sun, to construct fences, to form the ceiling of rooms, and to make baskets for carrying fruit, fish, &c. Sometimes baskets are made of palm-leaves, so close as to serve the purpose of buckets to draw water from deep wells. In the Maldive Islands, *bonnetta*, a species of fish, is preserved by a process in which coco-leaves are employed. The process consists in removing the back-bone, and laying the fish in the shade, occasionally sprinkling it with sea-water. After a certain period has elapsed, the fish is wrapped up in coco-nut leaves, and buried in sand, where it becomes hard. Fish thus prepared, is known in Ceylon, and perhaps over all India, by the name of *cummelmus*. The pieces of this fish brought to the market have a horny hardness. It is rasped upon rice, to render it savoury.

The unexpanded leaves are employed to shew marks of respect to persons in power. When the Governor or Chief-Justice travels, lines, made of the stems of creeping plants, are stretched along on each side of the road, about three or four feet from the ground. Upon these lines young palm-leaves are suspended. The head civil servant of a district may command the inhabitants under his immediate controul to adorn the road along which he passes, but he is not warranted in claiming this mark of attention beyond his own district.

The immature leaves of the coco-nut tree have a fine

yellow colour, and a beautiful texture resembling fine leather or satin. In some parts of Ceylon, the natives evince great taste in ornamenting triumphal arches, as also ball-rooms, and similar places of public resort, with the leaves of this tree, and some remarkably beautiful species of moss. As the young leaves are translucent, they serve to make lanterns, in the construction of which many of the inhabitants are very dexterous.

The practice of shewing respect to individuals by means of the branches of palm-trees appears to be very ancient. See Matthew xxi. 8, Mark xi. 8, and John xii. 13. The foliage of the palm tribe of plants has been in many countries considered an emblem of joy and victory, and hence the word palm is sometimes employed as a synonyme of victory and triumph. See Leviticus xxiii. 40. In ancient times, when pilgrims resorted to Palestine, they commonly returned bearing palm-leaves; on this account they were denominated Palmers. Captain Lyon, when describing the amusements of the natives of some parts of northern Africa, informs us, that the dancers "were directed by an old woman, with a torch in one hand, and a long palm-branch in the other, and sung in chorus verses which she repeated to them." In the island of Otaheite, the female inhabitants wear bonnets constructed of the leaflets of the coco; and, in Ceylon, the European soldiers manufacture hats of small strips of the leaves, in the same manner that straw-hats are made. Indeed, broad-brimmed hats of this construction are frequently worn both by Europeans and natives, particularly by fishermen, who are much exposed to the direct rays of an ardent sun.

The leaflets are sometimes used to write upon, and the instrument employed to make the impression is an iron stylus. The leaves of the Palmyra (*Borassus flabelliformis*), or Talipot (*Corypha umbraculifera*), are, however, much

more frequently employed for this purpose. Contracts and other legal instruments are often engraven upon tablets of copper, which have occasionally a border of silver. An allusion is made to the practice of writing upon tablets in Isaiah xxx. 8, and Habakkuk ii. 2. Palm-leaves generally undergo some preparation to fit them to receive the impression of the stylus. They are then called *ollahs*. The natives write letters to one another upon *ollahs*, which are neatly rolled up, and sometimes sealed with a little gum-lac. During the operation of writing, the leaf is supported by the left hand, and the letters scratched upon the surface with the pointed piece of iron. Instead of moving the hand with which they write towards the right, they move the leaf in a contrary direction, by means of the thumb of the left hand. To render the characters more legible, the engraved lines are frequently filled by besmearing the leaf with fresh cow-dung. This substance is then tinged black, which makes the writing very plain. Sometimes this object is obtained by rubbing the lines over with coco-nut oil, or a mixture of oil and charcoal-powder. The natives do not require tables to write upon; they can write standing as well as walking.

Baskets for catching fish, shrimps, &c. are made of the ligneous ribs of the leaflet; the same substance is employed by the natives for many of the purposes for which we use pins. A bundle of these ribs is in universal use, as a broom, to sweep the cottages; and when an European asks for a tooth-pick, his servant brings him a portion of one of these fibres. Lately, I am informed, they have been recommended to be employed as a nucleus for bougies.

In a domestic state, elephants are fed chiefly upon coco-nut leaves, and this animal evinces much sagacity in separating the elastic woody fibre from the thinner margin of the leaf.

For temporary purposes, cadjan-houses are frequently constructed, both by natives and Europeans. During the insurrection in the Kandyan country in 1818, many of the sick were accommodated in cadjan-hospitals. Except the frame-work, every part of the house, walls, and roof, is formed of coco-nut leaves. They are capable of resisting all kinds of weather for a year or more.

To prevent thieving, the owners of topes frequently fix a coco-nut leaf along the stems of fruit-trees. As the leaf rustles much when touched, a thief is cautious of ascending the trunk of the tree, lest he should alarm some of the inmates of the neighbouring huts. THUNBERG mistook the use of these leaves, and supposed that they supplied "the place of ladders, by means of which the natives could climb up, and gather the fruit *."

In warm climates, it is customary to travel during night, with the view of avoiding the influence of an ardent sun. Torches then become necessary, and coco-nut leaves are chiefly employed for this purpose. By tying the leaflets close to the centre-rib of a leaf, the ignition is prevented from being too rapid. Torches of coco-nut leaves are commonly denominated *chœls* (*ooloo attu*, Singhalese); they are in constant use, to obstruct the inroads of wild beasts upon cultivated fields, more particularly of elephants. In the interior of Ceylon, every field under cultivation must be watched during night, to prevent the depredations which would be made upon the crops, were these animals to have free ingress. When burned, the coco-nut tree, especially the leaves, afford a large proportion of potash. The caste of washermen avail themselves of this quality, and procure all the potash they require by the incine-

* Travels, vol. iv. p. 192.

ration of different parts of the tree. Soap is very little used by the native washermen in Ceylon.

Boats are rowed with the centre-rib of the leaf, in which operation it forms a substitute for paddles. The end of this part of the leaf is sometimes well-bruised, and thereby converted into a brush, that may be used for a variety of purposes.

The spaths, or fibrous covering of the blossoms, are inflammable; on that account they are often employed as torches. In some parts of India this part of the tree is soaked in water, and converted into coarse cordage, with which the thatch of houses is tied.

Many useful products are derived from the flower and fruit of this tree. By a peculiar manipulation the flower yields a rich saccharine juice, convertible into arrack or sugar. The word *arrack*, or *arak*, or *rack*, is probably a corruption of the Arabic word *uruq*, spirit or juice, indefinitely; whence we may infer that the art of distillation was conveyed from Arabia to India and the eastern archipelago. We are informed that, in the Ladrone Islands, it is called *uracu*. In Ceylon, and many other parts of India, the term arrack is employed in a sense similar to that with which we use the phrase spiritous liquors. Distilled spirits, of whatever kind, obtain this denomination through a great part of Asia, and along the northern coast of Africa. In the Singhalese language, sugar, manufactured from palm-juice, is called *hacburur*, which is commonly corrupted by foreigners into jagery, and may be the origin of the Arabic word *sukker*. A Sanscrit scholar has suggested, that *sugar* may be derived from the Sanscrit word *goor* (sweet); the superlative of which, he tells me, is *seogoor* (sweetest).

Sweet juice is extracted from the unexpanded flower, in the following manner:—A man, in colloquial language,

called a "Toddy-drawer," cuts off the point of the spadix, and ties the stump firmly round with a ligature. It is then beaten with a stick; which operation is supposed to determine the sap to the wounded part. This process is repeated for several days, cutting off daily a small portion of the end of the spadix. Under this management, the juice soon begins to flow from the cut surface of the flower, and is carefully collected in an earthen-ware vessel, suspended from the spathe. A thin portion of the flower and spathe is sliced off daily, and the end of the stump is bound with a ligature. A good healthy blossom will give from two to four English pints of sweet juice daily, and some flowers will continue to yield juice for about four or five weeks. Hence there are frequently two spaths on one tree, yielding toddy at the same time *.

I may here state the mode by which a toddy-drawer ascends the tree. He takes the dried stem of a creeping plant, and forms it into a circle of about a foot diameter. The feet are next put into this circular band. He then raises himself up a little on the stem of the tree, by means of his hands, and subsequently supports his whole weight upon the feet and the connecting ligature. By the alternate motion of his hands and feet, he reaches the top. The ordinary implements of a toddy-drawer, are, the shell of a large gourd, capable of containing several pints of sweet juice, and a broad knife, which he suspends to a belt tied round his waist. In Bombay, the stem is sometimes notched on each side, to enable the toddy-drawer to ascend the tree.

* "The Gomuti Palm yields toddy for two years, at the average rate of three quarts a-day."—CRAWFURD on the Indian Archipelago.

According to LABILLARDIERE, a date-palm will furnish, for upwards of two months in the year, six or eight *litres* of liquor a day.—"Account of a Voyage in search of PEROUSE, by M LABILLARDIERE, vol. i. p. 334.

But when it is intended to draw juice from a " tope" or cluster of trees, the toddy-drawer collects a quantity of some creeping plants, with which he connects the heads of a great number of trees. In some districts, coir-rope is used in place of these creepers. There are a number of species of creepers, suitable for this purpose, which have stems many yards long. The toddy-drawer selects a tree, of easy access, near to the centre of the tope, the trunk of which he surrounds with a number of bands made of some creepers, each at about a foot distance. He then ascends, by means of these bands, and passes along, from tree to tree, upon the connecting stems, assisted by the horizontal leaves, collecting, as he proceeds, the sweet juice, which he pours into the shell of the gourd, suspended from his waist, and conveys it to the ground by means of a line. The gourd is emptied by a person ready to receive it, and the line is drawn up by the man on the tree.

Juice is seldom drawn from a coco-nut tope, above six or seven months at a time, as this operation is supposed to exhaust the trees. During the intervening period, nuts are produced.

Toddy is the name given by the English to the sweet juices which are extracted from the different species of the palm tribe, including that of the coco-nut tree. It is perhaps a corruption of *tari or taree*, the Mussulman name of the juice of the Palmyra palm, of which *tar* or *tal* is the Sanscrit name *. *Ra*, which literally means juice, is the Singhalese name of the fluid extracted from the flower of a coco-nut tree. Sometimes it is called *Mee-ra* (honey or sweet juice); seldom, however, except when prepared for making *jagery*. Among the inhabitants of the maritime provinces of Ceylon, it is frequently denominated *suri*, which is said to be a Sanskrit word. With the above ex-

* Buchanan's Journey through Mysore, &c.

planation, the words *toddy*, *ra*, *mee-ra*, and *suri*, may be used synonimously. Fresh drawn juice is sweet, and has a peculiar flavour, in consequence of some extractive matter it contains; and, in general, it operates as a laxative. When it is intended to distil arrack from suri, the toddy-drawers seldom change or clean the pots into which it is received, hence the juice soon ferments, and emits an acid smell. In a half fermented state, suri is much relished by some Europeans. When it has become, by fermentation, highly intoxicating, the European soldiers, and the dissipated portion of the natives, drink it freely. To render this beverage acrid, the soldiers occasionally add green *chillies (Capsicum frutescens)* to it.

Is it not very probable, that the strong drink mentioned in Scripture was *mee-ra*, drawn from the flower of some of the palm tribe (palm-wine)? In several of the Oriental languages, there appears to be an intimate connection between the words which designate honey, sugar, sweetness, and the juice of the palm family of plants. *Mee*, in the Singhalese language, means honey, sweet; and the toddy, or juice extracted from palm trees, is called *mee-ra*. Juice drawn from the flower of the Sago-palm, is, by the Malays, denominated *Aer* (water) *saguer*. As the word *saguer* appears to be only a slight alteration from the Sanscrit adjective implying *sweet*, *aer saguer* will therefore literally mean *sweet water*, or the *sweetest water*. In the Javanese language, the juice of the Gomuti-palm is called *lagen*, which means the *sweet material* by distinction *. We learn from SHAW, that the Hebrew word rendered *honey* in Scripture, is, by some commentators, supposed to denominate the sweet juice procured from palm trees, as well as the honey of bees. He tells us that, in Barbary, the sweet juice extracted from date-palms, is called *dipse*; and that

* CRAWFURD.

dibse or *dipse*, which is a Hebrew word, is generally translated *honey* in the Old Testament *. Dr Mosely, in his Treatise upon Sugar, &c. says, that the strong drink of the Scripture was called *shecar*, a word which likewise means *intoxication*. This word *shecar*, does not differ much in enunciation from the Sanscrit adjective implying *sweet*; and it very closely resembles the Malay name of the intoxicating toddy of the Sago-palm (*Aer saguer*). Dr Moseley concludes his disquisition on the strong drink of the Old Testament, by saying, " What sottish liquor *shecar* was, no person knows. It was probably made from grain, perhaps from honey †."

The suri pots are sometimes visited, and the contents carried off during night. To detect the thief, the leaves of a species of datura are occasionally put into some of the pots. By means of the highly intoxicating effect of this compound, the marauder is often discovered.

Arrack may be distilled from suri the same day it is drawn; but sometimes this operation is delayed for a few days, without diminishing the quantity, or injuring the quality of the spirit. The process of distillation is carried on, in the maritime provinces, in copper stills; but, in the Kandyan Provinces, earthen-ware vessels are chiefly employed. Suri yields, by distillation, about one-eighth part of arrack, of the same strength as good brandy. Arrack, when well prepared, is clear and transparent: generally, however, it is slightly straw-coloured. It has a peculiar flavour, no doubt depending upon an essential oil which rises from the suri during distillation. Arrack is issued to the soldiers in India and Ceylon, as part of the established

* Shaw's Observations relating to Barbary and the Levant, vol. ii. p. 144, note.

† Medical Tracts, by Dr Mosely, 2d edit. p. 138.

ration. The seamen belonging to the Royal Navy in the Indian Seas are furnished with this spirit in place of rum.

Ceylon exports annually, and, for the most part, to the Presidences of Bengal, Madras, and Bombay, from 5000 to 6000 leaguers of arrack, each containing 150 gallons. Including freight, duties upon exportation and importation, this spirit is sold at Madras at about 1s. 8d. per gallon. The prime cost of arrack in Ceylon varies from 8d. to 10d. per gallon. It is stated by Mr Bartolacci, that arrack distilled at Batavia, is said to be sold in India from 10 to 15 per cent. cheaper than that brought from Colombo.* Ten per cent. duty is levied upon arrack exported from Ceylon. In England, this spirit has brought as high a price as from 5 to 6 shillings per gallon.

Batavian arrack is made from a mixture of molasses, palm-wine, and rice, in the following proportions:

Molasses, - - -	62 parts.
Toddy (palm-wine), - -	3 ditto.
Rice, - - - -	35 ditto.

100 parts of these materials yield 23½ of distilled proof arrack.

The rice is first boiled; and, after cooling, a quantity of yest is added to it, and is pressed into baskets. In this condition, it is placed over a tub or tubs, for eight days, during which time, a liquor flows abundantly from the mixture. At the end of that time, the liquor which has subsided, is taken out and mixed with the molasses and palm-wine, which has been previously combined. The mixture remains in a small vessel for one day only, when it is removed into large fermenting vats, in which it remains for seven. The liquor is finally removed into the still; and, according to the number of distillations it un-

* Bartolacci on the Revenue and Commerce of Ceylon.

dergoes, becomes arrack of the first, second, or third quality in commerce. The above account of the preparation of arrack, is extracted from Mr CRAWFURD's work on the Indian Archipelago. Mr MARSDEN * informs us, that the "Palm-wine" used in this kind of arrack, is obtained from the coco-nut tree, and that arrack of the first quality may be purchased for about 60 Spanish dollars; second for 50; and the third for 30, each leaguer of 160 gallons. At this rate, the best arrack may be procured for 20d. per gallon. It is at present manufactured chiefly for domestic consumption.

The phrase "Pariah-arrack" is often used to designate a spirit distilled in the Peninsula of India. Arrack, there prepared, is said to be often rendered unwholesome, by an admixture of *ganja* (*Cannabis sativa*), and a species of *datura*, with the intention of increasing its intoxicating quality. It is not clear, whether the term Pariah-arrack be colloquially employed to designate an inferior spirit, or an adulterated compound.

There is a spirit prepared in the neighbourhood of Madras, called *puttay* or *putta arrack*, literally bark arrack. *Puttay*, in the Tamool language, signifies the bark of a tree. Dr AINSLIE tells us, that the barks chiefly used in making arrack, are those of the *Mimosa ferruginea*, and the *Mimosa leucophlea* of Roxburgh †.

Suri is the yest commonly used by bakers in Ceylon. By allowing it to pass into the acetous fermentation, an excellent vinegar is obtained. A great variety of vegetable substances are pickled with vinegar of this kind.

When it is intended to extract jagery from suri, great care is taken to prevent it from fermenting. The earthen-

* History of Sumatra.

† Materia Medica of Hindoostan.

ware pot into which it falls is emptied twice or thrice in twenty-four hours. After this operation, the pot is always well cleaned, then dried, and a small quantity of *chunam* (lime) is thrown into it, before being replaced. Sometimes a portion of the bark of a tree, whose name I do not recollect, is introduced into the receiving vessel, instead of chunam. The lime perhaps contributes to check the progress of fermentation. Almost immediately after the *mee-ra* is drawn from the tree, it is filtered through a portion of the reticulated substance found at the base of the leaf.

The juice is then slowly boiled in an earthen-ware vessel, until it becomes light coloured, and acquires a considerable degree of consistency. While still warm, and semi-fluid, it is poured into sections of coco-nut shells, where it soon becomes solid. Twenty-four ounces of jagery may be procured from a gallon of *mee-ra*. I state the quantity of jagery which *mee-ra* yields, on the authority of Mr Bertolacci, who paid much attention to this subject. It would appear that *mee-ra* is richer in saccharine matter than juice expressed from the sugar-cane in the West Indies. Dr Mosely, in his History of Sugar, says, "We consider a pound of sugar from a gallon of cane-juice as good yielding." According to Mr Crawfurd, cane-juice in Java, yields, on an average, 25 per cent. of sugar. Jagery contains both the crystallizable portion of the juice, and a quantity of molasses, or liquid sugar; but, by a subsequent operation, they can be, in a great measure, separated. This coarse sugar is generally made into little loaves, having the shape of a hemispherical vase, from the form of the vessel in which it cools. It has a deep chocolate colour; and, when broken, presents many clear shining particles of sugar. In the Malay language, jagery is denominated *goola* or *goora itan* (black sugar or black sweet.)

The ordinary price of jagery is about 2d. per pound. It is the only sugar used by the native inhabitants, and no other is prepared in Ceylon. They enjoy the juice of the cane, by masticating the green shoots, but in no other way, although they have a name for sugar extracted in other countries from this plant, which is *sinee* or *chinee*. The common soldiers ordinarily use jagery; and many Europeans of the upper ranks prefer it to a more refined species of sugar for sweetening coffee. Sugar-candy, which is chiefly imported from China, is the saccharine substance commonly used by the higher classes of Europeans in India. In some parts of the interior of Ceylon, particularly in the vicinity of Adam's Peak, great numbers of the inhabitants support themselves by extracting a sweet juice from the nepery tree (*Caryota urens*), and manufacturing it into jagery. This tree grows spontaneously in the woods. The people thus employed, subsist chiefly upon coarse sugar. They occasionally procure a little rice and salt by barter, but they do not raise grain by cultivating the soil.

There is some foundation for supposing, that the sugar of the ancients, which seems to have been imported from India, was the produce of the palm family of plants, and not that of the sugar-cane. SALMASIUS, the commentator of PLINY, is decidedly of opinion, that the sugar of the moderns is the produce of a different plant from that which produced the sugar of the Greeks and Romans. All the authors on this subject, with whose writings I am acquainted, describe the sugar of the ancients as being of a very coarse quality, and mixed with a large portion of molasses, exactly resembling *jagery*, the produce of some of the palms. VIREY, in his Account of Sugar, says expressly, that "le premier sucre apporté des Indes n'etoit qu'une *moscouade* (*sucre brut*)." And, in an Essay upon the History of the Commerce of Venice, it is stated, that the sugar which was manufactured in Sicily, as early as

1173, brought a higher price than that which they imported from Egypt or from India, by the way of the Red Sea. The extraction of sugar from the sugar-cane is much more operose than from the juice afforded by palms; and this may be one reason why palm-sugar should be more early known than cane-sugar, even in countries where the sugar-cane is indigenous.

Among the articles of commerce which the Venetians imported from Asia, about the year 996, sugar is mentioned; but whether it was the produce of palm trees, or the sugar-cane, cannot be satisfactorily ascertained *. It is the opinion of Mr MARSDEN, that the sugar of the ancients was procured from palms. In his History of Sumatra he says, "If the ancients were acquainted with sugar, it was produced from some species of the palms; as the sugar-canes were not brought into the Mediterranean from the coast, till a short time before the discovery of the passage to India by the Cape. The word *saccharum* is conjectured to be derived from *jaggree*, which the French pronounce *schagaree*." His opinion is corroborated by Dr CRAWFURD, who informs us that, "although the cane be a native of the Indian Islands, the art of manufacturing sugar from it is certainly a foreign art. There is no name for sugar in any dialect of the Indian Islands, but a foreign one *gula* (*perhaps a corruption of* goor *sweet*); and this foreign one is pure Sanskrit. When Europeans first became acquainted with the natives of these islands, they found them ignorant of the manufacture of sugar from the cane. The Hindoo word *gula* (*sometimes written* gour) is indeed equally applicable to palm sugar as to that of the cane. I therefore suppose that the Hindoos instructed the Indian islanders only in the simple process of manufacturing the former, and that the manufacture of the latter was in-

* Essai de l'Historie du Commerce de Venise, p. 71.

troduced by the Chinese, under the auspices chiefly of Europeans, and in times comparatively very recent." I am aware, however, that HUMBOLDT infers, from some Chinese paintings which he saw at Lima, representing the different processes for extracting sugar, that this art is extremely ancient in that country.—(*Essai Politique sur la Nouvelle Espagne*, tom. ii. p. 425, 4to.)

It is stated, upon the authority of the Crusaders, that the inhabitants of Tripoli, in Syria, were acquainted with the art of extracting sugar from the sugar-cane, as early as 1108. The process they practised was extremely rude, and consisted in pounding the cane in a mortar with a pestle. At this time, they do not appear to have been acquainted with the means of employing fire in the making of sugar. The expressed juice was set aside until crystals formed in it *. For a long time, sugar appears to have, in Europe, been confined to the apothecary's shop; and, by some of the older authors, it is recommended as a good substitute for honey, to render nauseating medicines palatable; this seems to have been the chief purpose for which it was, during a considerable period, employed. Sugar did not become general, as an article of food in Europe, until it was extensively cultivated in the West Indies and America †.

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* FALCONER's Sketch of the History of Sugar.

† Neither sugar nor the sugar-cane is mentioned in Scripture. The word *Sweet-cane*, which we find in two places of the Old Testament, Isaiah xliii. 24., and Jeremiah vi. 20., seems to express a different substance, most probably cinnamon. In both passages, sweet-cane is mentioned as an article of merchandize, and not as a native of Judea, which the sugar-cane seems to be. It likewise may be inferred, that the substance here meant was consecrated to religious uses. Now, we know that, under the Levitical law, cinnamon was required to compose the holy oil for anointing the tabernacle. Europe is indebted to the conquests of ALEXANDER, for a knowledge of sugar.

SPRENGEL,

When intimately mixed with lime, jagery forms an excellent cement, which resists moisture, and endures great solar heat. It is capable of taking on a very fine polish. Walls are prepared for receiving this covering, by wetting them with a strong infusion of the husk of unripe cocos; and the same kind of fluid is used for mixing and tempering the materials. In Madras, and some other parts of India, the flat tops of the houses are covered with this cement. It is much employed to cover columns, as also to form the floors of rooms. Floors of this kind are sometimes stained and made to resémble the finest marble. It is said that jagery-cement has succeeded very well in Holland. In 1813, Ceylon exported jagery to the value of 39,245 rix dollars. The Ceylon rix dollar at par, is equal to 1s. 9d. Sterling.

When the flower has not been injured, the tree bears nuts which are converted to many useful purposes. Young coco-nuts are much used by the natives as an article of diet. During the unripe state of the fruit, the shell is lined

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Sprengel, in his Historia rei Herbariæ, informs us, that the sugar-cane is a native of the banks of the Euphrates; and that the first account we have of the fabrication of sugar from this plant, is not earlier than the fifth century. From Arabia, this reed found its way to Egypt, and eventually to Europe. In 1306, it was common in the Island of Cyprus; and, a hundred years after, it enriched Calabria, and the coasts of Spain. While Spain was under the dominion of the Moors, the sugar-cane was cultivated in Andalusia, and sugar manufactured from it. From Sicily it passed to Madeira, and the Canary Islands. Early in the sixteenth century it was transported to America, by a native of Portugal. Oviedo saw some sugar manufactories in operation at St Domingo, in the year 1513; and, in 1520, it was carried to the Continent of America. In 1535, Gonzales de Velosa constructed the first cylinder for expressing the sugar cane; and, in 1641, canes were transplanted from Brazil to Barbadoes, and thence to the other West India Islands.—Humboldt's Personal Narrative, vol. iv. p. 179; Journal de Pharmacie, tom. ii. p. 386; Rees' Encyclopædia, Article *Sugar*.

with a pulpy substance, while the centre is filled with an aqueous fluid. This fluid is at first slightly astringent and sub-acid; as the fruit ripens, it becomes sweetish, and not unlike the colour and consistence of the whey of milk *. When drank before the sun has far advanced, it is much cooler than the atmosphere, and is then a pleasant beverage. Natives, particularly when travelling, generally furnish themselves with a few unripe nuts (*Lanias* Portuguese), the water of which they drink, and eat the pulpy portion or kernel. Upon a few repasts of this kind, a man will labour from morning till night, without any other article of diet †. The native inhabitants of the coasts of some of the islands in the Equinoctial Zone, are more palmivorous than granivorous. Where a people can be satisfied with food so easily procured as the produce of the coco-nut tree is, in some tropical regions, they are little sensible to the ordinary motives which impel mankind to labour. The Reverend Mr Cordiner says, and perhaps with truth, that the person who possesses a garden with twelve coco trees and two jack trees, has no call to make any exertion.

The husk or fibrous pericarp of the nut is employed to polish furniture, and to scour the floors of rooms, &c. Birds, who build pendulous nests, commonly construct them of this substance. Its chief use, however, is in the

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* The following are the proportions of the liquid contained in the nut, as given in the Journal de Pharmacie, tom. ii. p. 98., extracted from Trommsdorff's Journal:—"Le liquide est clair et sans couleur comme de l'eau, sans odeur, et d'une saveur douceatre semblable aux noix. La pesanteur specifique comparée à celle de l'eau est de 1,010."

The result of a chemical examination of the liquid is, that "le suc de la noix serait composé de beaucoup d'eau, du sucre liquide, d'un peu de gomme, et d'un sel vegetal.

† To fetch coco-nuts from trees as they are wanted, the Malays have trained monkeys, which are more expert at the business than any *toddy-drawer* on the coast of Coromandel.—Heyne's Letters on Sumatra.

manufacture of *coir*, and for this purpose the nut ought not to be completely ripe. The word *coir*, sometimes written *cair*, and *caira*, is probably derived from the Portuguese substantive *cairel*, a periwig, or fringe. The Singhalese word for *coir* is *kohu*. To remove the husk, an iron-spike, or sharp piece of hard wood, is fixed in the ground; the nut is then forced upon the point, which passes through the fibres, thereby separating the rind from the shell. In this manner a man can clear 1000 nuts daily. *Coir* is prepared by soaking the rind in water for several months, and then beating it upon a stone with a piece of heavy wood. On the coast of America, where a running stream of water is not near at hand, the coir-manufacturers dig holes in the sand below high water-mark, and bury the rind of the coco-nut, before beating it. Subsequently it is rubbed with the hand until the interstitial substance be completely separated from the fibrous portion of the husk. The rind of forty cocos furnished Mr KOSTER with six pounds weight of coir. The next operation is to twist the fibres into yarns, which are manufactured into cordage of all sizes. Coir is remarkably buoyant, and well suited for ropes of a large diameter. Until chain-cables were introduced, all the ships which navigated the Indian seas had cables made of this substance. Sea-water is said to be rather beneficial than hurtful to it. Coir-cordage, when properly prepared, is pliable, smooth, strong, and elastic: it is very well suited for running-rigging, more especially where lightness is deemed an advantage, such as top-gallant studding-sail sheets, &c. On account of its contractility, seamen consider it not well fitted for standing rigging. Dr ROXBURGH, in his observations on the comparative strength of English hemp and other vegetable fibres, states, that he found hemp-rope and coir-rope, when large, to be respectively as 108 to 87 in strength, and when

smaller, as 65 is to 60. In the same paper (Transactions of the Society of Arts, vol. ii.), he says, " Coir is certainly the very best material yet known for cables, on account of its great elasticity and strength."

The natives sew the planks together which compose their boats with coir-yarns. When twisted into yarns adapted for being manufactured into cordage, it is valued in Ceylon at about L. 2 per candy (500 lb.) Large quantities of this substance are exported to the different ports in India. Under the Dutch Government about 3,000,000 lb. were annually manufactured in the island. The quantity of coir exported from Ceylon in 1813, amounted to 4,048½ candies, and each candy may be valued at 28 rix dollars, total amount rix dollars 137,649. Very lately a manufactory for the making of coir-cordage has been established upon a large scale at Recif, near to Pernambuco, on the coast of Brazil.

Coir is much used in India in place of hair to stuff mattresses, cushions for couches, saddles, &c. It is also employed to make brooms and brushes to white-wash houses.

The kernel of the ripe coco-nut is not unlike the substance of an almond either in taste or consistence *. It is

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* The following chemical analysis of the kernel of the coco-nut I have extracted from the Journal de Pharmacie, tom. ii. p. 100:—

" La partie charnue a le consistance de nos noix fraîches; mais elle est plus tenace, d'un blanc éclatant, et d'une saveur douceatre."

" Il resulte que le noyau, ou la partie charnue de la noix, est composé de beaucoup d'huile grasse, se figeant aisément, ce qui peut engager à lui donner le nom de *beurre végétal*, d'un liquide aqueux, d'albumine, et de sucre liquide (mucoso-sucré)."

" En jetant un coup d'œil sur cette analyse, nous voyons que la noix du cocotier est une substance très nourrissante; car l'albumine est connue comme nourrissante quand même elle ne servirait ici qu'à animaliser les autres matières vegetales. Le sucre et l'huile sont egalement connus comme

eaten by the natives, and frequently along with jagery. The natives of the Ladrone Islands eat it in lieu of bread, with meat and fish. Sometimes it is rasped into very small pieces, and mixed with dressed rice, to give it a peculiar flavour; and occasionally it is pounded into meal, of which fritters and small cakes are made. In India this fruit is generally allowed to be very nutritious, and many suppose that it possesses the quality of inducing corpulence.

By a little pressure the kernel may be made to yield a white fluid resembling milk. When the milk of cows or buffaloes cannot be procured, Europeans sometimes add this liquid to tea as a substitute. Another substitute for milk may be obtained by rasping a kernel, and mixing the scrapings with some of the liquid contained in a nut: this mixture requires to be strained. We are informed by Dr PINCKARD, in his Notes on the West Indies, that puddings are made of coco-nuts in Barbadoes. The kernel is sometimes pressed with honey and sugar, and used to make preserves.

When mature, the nut is much used in Ceylon, to furnish an oleaginous fluid required to prepare *curry*, a dish in very general use among all ranks and classes in India. For this purpose, the kernel is finely rasped by means of an iron instrument called a *homeny*, which resembles the rowel of a spur, and the raspings are washed with a small quantity of water, which is subsequently filtered. The emulsion thus formed is boiled along with the meat, fish, or vegetable substance intended to be "curried," and

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des principes, nourrissans. Le noyau a beaucoup d'analogie avec le lait animal. Ce qui constitue dans le lait la matiere caseuse, est remplacé ici par le mucoso-sucre, et l'huile epaisse peut presenter le beurre du lait animal. On peut separer ici l'huile de la meme manière qu'on sépare le beurre du lait."

thereby supplies the oily fluid necessary in the composition of curry. A due proportion of spices is added to the mixture before it is removed from the fire. When coco-nuts cannot be procured, *ghee* (clarified butter) is used as a substitute in the preparation of this delicious dish. In Bengal, and, I believe, over great part of the peninsula of India, curry is chiefly prepared with butter or ghee. The Ceylon or coco-nut curry possesses much of the flavour of the nut; it has a light-yellow colour, and is easily digested, the oily part of the mixture being seldom too abundant.

But the chief product of the kernel of the coco-nut is an excellent oil: and, to extract it, two different processes are employed; namely, decoction and expression. When the former process is followed, the fresh kernel is finely rasped; the raspings are next washed with water, which assumes a milky appearance; and, by decoction, yields a limpid oil. If the emulsion be exposed for a night, it separates spontaneously into an oily and a watery portion, and the oily part is purified by a very short boiling. To separate the oil, the operator, who is generally a female, lays the palm of her left hand flat upon the surface of the fluid; a portion of oil adheres to the hand, which is brushed off into a vessel by the right hand. The oil made in this manner is nearly as colourless as water, and when newly prepared does not smell offensively. In the course of a few days, particularly if exposed to the atmosphere, it emits a disagreeable odour. On an average ten nuts are stated by Mr Bartolacci to yield about a quart of oil; but Koster, who made the experiment, says, that thirty-two nuts rendered him only 3 lb. of pure oil.

Compression is the process chiefly adopted when coco-nut oil is prepared in the large way. After clearing the nut of the husk, the kernel is exposed, which is effected by breaking the shell with a crooked knife, an operation which

is generally performed by one stroke. The watery part of the kernel is dissipated by exposing it to the sun for a few days, during which period it acquires a considerable degree of rancidity. In this state the kernel is called *copra*, or *copperas*. The oil is extracted from copra by grinding it in a very clumsy mill, which is worked by bullocks. Oil has for some years past been extracted from copra in large quantities at Colombo, by means of the power of a steam-engine. The value of copperas exported from Ceylon, in 1813, amounted to 27,975 rix dollars.

The substance which remains after the oil has been extracted from *copra* is called *taur*, which serves well to feed pigs, poultry, &c.

Ceylon exports annually a great quantity of coco-nuts, chiefly to India. In 1809, the number amounted to 2,977,275. The medium price may be stated at about 3s. 6d. per hundred, or nearly one halfpenny a-piece. According to KOSTER, the value of coco-nuts in Brazil is about 5s. 6d. per hundred, or a little more than $\frac{6}{10}$ths of a penny each. In Ceylon they pay an export duty of 5 per cent. These nuts are sometimes brought to this country from the West Indies. The captains of ships use them instead of wedges of timber, to fill up the vacua between the casks and other packages which compose their cargoes. On this account, the freightage of the nuts adds little to their original value. They are therefore now said to be as common in the shops and streets of London as the orange. I know they may be procured in great abundance at Liverpool.

Coco-nut oil may be exported from Colombo, at about 1s. 6d. per gallon; and, at this price, a large quantity is annually sent to different parts of India. In Java, where it is an article of importation, the market price is usually about six Spanish dollars a-picul, which is equal to about

1s. 9d. per gallon. Within these few years it has been imported into Great Britain, where the same quantity has been sold as high as from 5s. to 6s. The quantity exported from Ceylon, in 1813, amounted to 27,265 measures, each measure about two pints; value in rix dollars 7952.

In Ceylon this oil is universally used both by Europeans and the indigenous inhabitants, as a lamp-oil. The natives burn it in a section of the coco-nut shell, or in a small earthen-ware vessel. Some of the upper ranks have brass lamps four or five feet high, which have several flat basins, with projecting beaks, affixed to a vertical stalk. The oil is introduced into the basins, the beaks of which are furnished with cotton-wicks. Torches are prepared in Siam, by drying elephants' dung, soaking it in coco-nut oil, and then covering the mass with long dry leaves tied at short distances, with shreds of bamboo.

The Singalese, and indeed a great proportion of the inhabitants of Asia, use considerable quantities of this oil, for the purpose of external inunction. It is not easy to ascertain precisely the benefits they expect to result from this practice. Some of the Orientals say, that inunction is used for the purpose of preserving their skins from the sun and wind. They sometimes anoint their bodies previously to going into the bath, probably for the purpose of diminishing the shock they might feel by a sudden reduction of the temperature of the skin: more commonly, however, the inunction takes place upon emerging from the water. The oil is applied with a considerable degree of friction; or, as DAMPIER describes the process, "Chafing it for half an hour into hair and skin;" and the whole surface of the body, from the crown of the head to the soles of the feet, is generally anointed. It is perhaps more frequently applied to the hair of the head than to any other part of the body. I cannot, however, learn that they intend to destroy

vermin by this means, although, in all probability, it may have such an effect. The Asiatics, without much exception as to rank, do not seem to consider this source of disquietude as either uncomfortable or disgraceful. Captain LYON, who seems to have practised the inunction of oil, while in Northern Africa, says, " It is very refreshing, after a long day's journey, to be well oiled over."

Coco-nut oil is a good substitute for olive oil, in the composition of pharmaceutical preparations, such as ointments, plasters, &c. In the laboratory at Colombo, it is employed in a number of the preparations where olive-oil is directed to be used by the different pharmacopœias. One of the editors of the Journal de Pharmacie, says, respecting coco-nut oil, " J'ai aussi observé que cette huile divisait mieux le mercure qu'aucune autre huile végétale."—(Tom. ii. p. 101.)

Mixed with *dammer* (a species of resin) and the compound melted, a substance is formed which is much used in India to pay the seams of boats and ships, in place of pitch. The same compound is employed to protect the corks of wine and beer bottles from the depredations of white ants.

In this country, it has been employed as a lamp-oil, and in the manufacture of cloth, instead of olive-oil. Soap and excellent candles are made of it; and I am informed the glass-blowers prefer this oil to all others in their operations.

Hitherto the importation of coco-nut oil into Europe has been attended with much waste by leakage, in consequence of having been imported in casks, the wood of which permits the contents to pass through in large quantities. Between the tropics, the temperature of the cabin or cuddy of a ship, is frequently as high as from 83° to 86° Fahren.; that of the hold must be considerably higher. Coco-nut oil does not freeze until the temperature be reduced to 73°

Fahren. Hence it is in a fluid condition during the greater part of the voyage from India.

The shells of coco-nuts are manufactured into beads for rosaries. They are also used as drinking-vessels, and for various other domestic purposes. Occasionally they are polished by the natives, who cut figures in relief upon them. When thus ornamented, they are sometimes employed by the English as sugar-basins. In the neighbourhood of Monte Video, in South America, the ladies drink an infusion of an herb called *matte* (Paraguay tea) from highly ornamented coco-nut cups. They extract the tea from the cup by sucking it through a long silver tube. The common ladle used in great part of India and in the Brazils, is formed of a part of a nut, to which a long wooden handle is fixed. In America they have even given a name to the instrument, for ladles made of silver are called *silver cocos*. By the inhabitants of some of the Oriental Islands, they are employed as a measure for ascertaining the quantity of both dry and fluid substances. Their capacity is known by the number of *cowries* (Cyprea moneta) they will contain. Hence there are cocos of 500 or 1000 cowries, and so on.

They are used as fuel by the goldsmiths; and, when converted into charcoal, they are mixed with lime, and employed to colour the walls of houses.

As an article of the Materia medica, the natives of India recommend a decoction of the roots of the coco tree, mixed with ginger, as an excellent febrifuge. The juice expressed from young branches, combined with oil, is said to be a useful application to hæmorrhoids. In chronic inflammation of the bladder, and gonorrhœa, they recommend a mixture of the expressed juice of the flower of the coco-tree and sugar. The oil is said to be useful, if applied to ulcers or pustules on the head. Mixed with salt, and drank to the quantity

of eight ounces, it is said to expel worms from the intestines. Particular virtues have been attributed to cups made of the shell of the nut. They have been supposed to give an antiapoplectic quality to intoxicating liquors. Many other virtues are ascribed to different parts of the tree, of which it is not necessary here to take notice.

When coco-nuts are intended for seed, they are placed close to one another, with the holes uppermost, and covered with a small quantity of earth. In a short time, the aqueous fluid is absorbed, and the cavity becomes filled with a spongy-white substance. Through the largest of the three holes the plumula passes, and sometimes along with it the radicles, which run downwards on the outside of the shell. The seedlings are allowed to remain in this state for about a year before they are transplanted. Holes of about 2 feet deep and from 25 to 30 feet distant from each other, are dug in the field intended for a coco-nut garden, and the young shoots put into them. A little earth is put round the nut; and, in dry weather, the plants are watered. They require to be protected from cattle, and particularly from elephants.

VIII. — *Observations on the Organs of Digestion and their Appendages, and on the Organs of Respiration and Circulation, in the* Ornithorynchus paradoxus *.

By Robert Knox, M. D.
Member of the Wernerian Natural History Society, and of the Medico-Chirurgical Society of Edinburgh.

(*Read 26th April* 1823.)

Memoir II.

So extremely accurate, generally speaking, are the descriptions of the celebrated Cuvier, so just and profound the views he has adopted of the animal creation, that those pursuing the same route can hope to add but little to any

* The specimen of Ornithorynchus, examined by Dr Knox, was transmitted to the Royal Museum of the University of Edinburgh by His Excellency the Governor of New South Wales, Sir Thomas Brisbane, Baronet. It it highly gratifying to learn, that this distinguished individual is actively employed in forming an extensive collection of the natural productions of the vast country over which he rules; and that the numerous, uncommon, marine animals of the neighbouring coasts and seas, which have so much excited the curiosity of European naturalists, also engage his particular attention, so that, ere long, we trust, many of these will reach our National Museum of Scotland, and thus afford opportunities for interesting investigations and discoveries.—Edit.

individual portion of anatomical science to which the undivided attention of that distinguished author has been directed. This observation will explain the brevity of this and the succeeding Memoirs on the anatomy of the Ornithorynchus, for most of the internal organs, which now fall to be described, have been already submitted by him to a minute dissection.

It has been already remarked, that, properly speaking, there is no ascending branch of the lower jaw in the Ornithorynchus, instead of which there is found only a slight curvature; the coronoid process is small, though sufficiently distant from the condyle; and the general disposition of the glenoid cavity, for receiving the condyle, seemed to me such as to admit of extensive motion from before, backwards, and also horizontally. This agrees with the configuration of the mouth and palate, and with the total absence of all cutting or incisive teeth. Whatever be the food swallowed, whether insects or aquatic vegetable matter, it must be submitted to a certain degree of trituration in the mouth, and, to effect this completely, is conveyed into two large bags or cheek-pouches placed on each side of the head, and the only entrance into which is between the large grinding-teeth. This was essential to the existence of the animal, and results from the structure of its stomach, which, being totally without that strong cuticle and powerful muscles by which the food is triturated in birds and some other animals (as in the *Myrmecophaga capensis*), required that the whole of the functions of mastication, the complete trituration of the food, and its reduction to a pulpy mass fit for the immediate action of the gastric juices, should be performed in the mouth. The cheek-pouches, situated a little behind the angles of the mouth, are capable of containing a considerable quantity of food; they are lined by a strong cuticle, and have posteriorly a gland, which evidently pours

its secretions into the corresponding pouch, and must be considered as the parotid. They are formed chiefly by the buccinator muscle, and are supplied by branches of the facial nerve.

The teeth of the Ornithorynchus have generally been described as four in number, that is, four large grinding-teeth, placed two in either jaw, at the entrance of the cheek-pouches: but some anatomists seem to have overlooked four narrow, horny bodies, placed over the maxillary bones, in the same line with the grinding-teeth, but anteriorly to them. They are about $\frac{7}{10}$ths of an inch in length, and $\frac{1}{10}$th where broadest. They are composed of a horny substance, and are evidently of the same nature with the true grinding teeth: they are to be considered as corresponding to the smaller grinders of the Mammalia *. The structure of the larger grinding teeth has been considered by M. Cuvier as the most extraordinary amongst quadrupeds. They are said to be composed of a great number of small, straight, and parallel tubes, so that the surface of a transverse section resembles absolutely that of a bamboo-cane (*jonc à canne*): these tubes are not closed, and the tissue of the tooth is compact only at the triturating surface: there is no large cavity in the interior of the tooth. These peculiarities in structure, described from the teeth of the Orycteropus, may readily be distinguished in the larger grinding teeth of the Ornithorynchus. These on their grinding surface were very much hollowed out, instead of being tubercular; they may be fairly considered as connected with the integuments only, since their structure is so different from the teeth of all other animals, and

* I have made no mention here of the two teeth which are implanted into the tongue, and which were described with that organ in a former memoir

the alveolar cavity, into which they are received, is lined throughout by the true dermis; they are simply analogous therefore to cuticle, horn, &c., and have nothing osseous in their composition.

The salivary glands need not detain us long. The parotid has been already described. The only other salivary gland which I remarked, was the maxillary, situated on either side, over the great nerves and bloodvessels, high in the neck, and close to the lower jaw. From this there proceeded a long canal passing over and through the muscles going to the tongue, and running parallel to that organ; near its termination it becomes very zigzag, and diminishes in caliber; it pierces the membrane of the mouth at the sides of the anterior portion of the tongue, and near the union of the branches of the lower jaw-bone. These maxillary glands are large, but not remarkably disproportioned to the size of the animal, as is said to be the case in the Echidna, in which animal the parotids are wanting.

It could scarcely be interesting to the Society to detail the observations made on the muscles of the tongue, palate, and of those connected with the *os hyoides*, as it would be but a repetition of what has been already so well described by M. Cuvier. The larynx itself is composed of the usual cartilages and muscles, sufficiently distinct; the epiglottis and arytenoids are well marked, and I thought the thyro-arytenoids rather strong: the glottis is formed partly by the arytenoidei cartilages, and partly by the true vocal ligament; between which and the superior margin of the cricoid cartilage there is a considerable cavity or ventricle. Immediately above the vocal ligament and thyro-arytenoidei muscles, a small ligamentous and partly muscular cord, stretched from the base of the epiglottis to the anterior part of the arytenoid cartilages, running parallel with the true vocal cords, and immediately outside this, is a much lar-

ger muscular fasciculus, arising from the anterior part of the base of the epiglottis (or, anterior and superior, supposing the epiglottis to be laid down upon the glottis), and running parallel with the preceding, to be fixed into the base of the arytenoid cartilages. These cords correspond with the superior or anterior vocal ligaments of the Mammalia, and there even appeared to be a small cavity or ventricle situated between them and the true vocal cord.

The anatomy of the stomach, intestines, and liver, was found to coincide with the details in the *Anatomie Comparée* *. The following table will give an idea of the proportional length of the intestinal canal in the Ornithorynchus, Echidna, and Fourmilier.

Name.	Length of the animal.	Length of Small Intestines.	Length of the Cæcum.	Length of Colon and Rectum.	Total length of the Intestinal Canal.	Ratio of the length of the Body to the Small Intestines.
Fourmilier, C.	0.162	0.519	2 Cœc. 0.004	0.081	0.608	: : 1 : 3.8
Echidna, C.	0.370	2.250	0.022	0.580	2.830	: : 1 : 7.8
Ornithoryne. C.	0.215	0.851	0.020	0.243	1.114	: : 1 : 5.2
Ornithoryne. R. K.	0.410 16½ in.	1.000 39 inch.	0.023 1 inch nearly	0.256 10 inch.	1.256 49 inch. 50 cœc. includ.	

It is evident, I think, that the viscus called *cæcum*, in the Ornithorynchus and Echidna, is merely an *appendix vermiformis*. A number of dark-coloured glands are situated at the base of this appendix, and betwixt its tunics.

* The spleen seemed to me to be bilobular, and measured nearly 4½ inches in length; it was regular as to situation.

The internal lamina of the small intestines is known to be very peculiar; it forms a number of circular and parallel laminæ close to each other, which diminish greatly the diameter of the canal. They are so incredibly numerous, as to give to the internal lamina of the intestines an extent, which I should scarcely think to be equalled comparatively in any other animal. These folds disappear near the termination of the small intestines in the colon. The peculiarities in the termination of the rectum, in the structure of the cloaca, and anus, have been already noticed; the most ample details relative to this part of the anatomy of the animal, and more particularly as regards the distribution of the suspensor muscle of the cloaca, as being more connected with a systematic work, will be found in the third volume of the *Anatomie Comparée*.

There is little peculiar in the structure of the trachea and lungs; the cartilaginous rings of the former are incomplete, as in the Mammalia. The trachea divides at an acute angle into two bronchial tubes, which pass immediately to each lung: the whole inner surface of the windpipe is studded with small transparent cartilaginous bodies, like millet-seeds. A number of small glandular bodies were found close to the upper part of the trachea, and precisely in the situation of the thyroid gland, nor could any other be discovered. The elasticity of the lungs is considerable, and the capacity of the chest shewed that the quantity of air taken in at each inspiration must be very great in proportion to the bulk of the animal.

There is undoubtedly something of an ornithological character in the structure of the heart; the valves placed at the entrance of the venæ cavæ into the right auricle seemed to me in a great measure muscular; and the right auriculo-ventricular valve was much more muscular than membranous. The bloodvessels had suffered so much by

maceration, that nothing could be made of this part of the dissection; the blood was every where coagulated into small, white, rounded, friable masses. The sinus placed between the liver and diaphragm, and which is known to be so large in most aquatic mammalia and in diving birds, was of considerable size in the Ornithorynchus. I need scarcely mention that the *foramen ovale* of the heart was closed, and that the *ductus arteriosus* had disappeared The delicate tendinous-looking fibres, which pass from one paries of the right ventricle to the other, have not escaped the notice of M. CUVIER. After what I have said of the strictly mammiferous character of most of the organs described in this memoir, it may be hardly necessary to mention, that there existed no appearance whatever of an inferior larynx.

The numerous lymphatic glands found in various parts of the body, shew a very completely organised system; a string of lymphatic glands exist in the lower and anterior part of the neck; they are about the size of small peas, and of a dark-red colour, occasioned probably by the spirit in which the animal had been preserved. Numerous lymphatic glands are found likewise in the axilla, in the course of the jugular vein, and under the splenius muscle. The mesenteric glands were present, and sufficiently numerous.

The accompanying drawing of the abdominal viscera, by Mr WATSON, will enable the members of the Society to comprehend the general appearance and distribution of these organs.

Memoir III.

On the Kidneys, Urinary Bladder, and Organs of Generation, in the Male of the Ornithorynchus paradoxus.

The kidneys had suffered so much by long maceration in spirits, that they were reduced to a pulpy, homogeneous mass, which gave way under the smallest pressure. Nothing could be made of their internal structure. It is stated in the *Anatomie Comparée*, that the medullary portion of the kidneys in the Echidna terminates by four papillæ, and that the pelvis of the kidney is confounded with the calices. Two ureters, very distinct in the Ornithorynchus, conduct the urine into a urinary bladder, thin in its parietes, but quite proportioned to the size of the animal. Air blown into the bladder by the blowpipe readily passed into the ureters, which I imagine to be rather a rare circumstance, as I do not remember to have found it so in any other animal. It is stated in the *Anatomie Comparée*, that the insertion of the ureters is placed in all animals at a certain distance from the neck of the bladder, excepting in the Echidna and Ornithorynchus, in which this insertion takes place beyond a little swelling *(bourrelet)*, which seems to separate the bladder from the urethra, in such a way, that the ureters open into this latter canal, rather than into the bladder*; nevertheless, by inserting the blowpipe into

* On slitting up the urinary bladder somewhat farther than is represented in the drawing, I do not find this to be borne out by the appearance of the parts.

either of the ureters, the urinary bladder may be readily distended, and will remain so, though no compression of the urethra be employed.

I did not satisfactorily make out the supra-renal glands, but I am willing to ascribe this apparent exception to a very general law, to the state of the organs, which did not permit me to distinguish them from the kidneys.

The dissection of the organs of generation in the male Ornithorynchus was performed with a care proportioned to the usual intricacy of the parts, and to my knowledge of the very extraordinary contradictions existing in the writings of authors of the highest merit. The errors which anatomists had committed in their descriptions of the organs of defence, the poison-gland and spur, I am still inclined to consider as purely an omission on their part; for such was the distribution of the gland and duct, as exhibited in drawings to the Society, so easy its display, that the merest student in anatomy could, with sufficient patience, have made out the structure of the whole; but every anatomist knows, that the organs of generation are, generally speaking, the most complex of the frame, and require, in order to be unravelled, the most delicate dissection. The result of the inquiry is as follows.

The preparatory male organs, that is, the testicles, are placed in the abdomen near the kidneys, and they seemed to me to be constantly fixed there. The epididymis was proportionally large, but I could perceive nothing very remarkable in the *vasa deferentia*, which proceeded directly, without any dilatation, but rather a slight contraction, to terminate in the urethra, close to the entrance of the urinary bladder, into the same canal. The small longitudinal holes, by which they open into the urethra, are directed upwards, so that on introducing the tube of an ANEL's syringe into the *vas deferens* near the epididymis,

the contained fluid passed out perpendicularly upwards, and not in the direction of the *vas deferens* itself: a small mucous papilla is placed near the orifice of each *vas deferens* *. But previous to our proceeding farther with the description of these organs, we must revert to the more external parts, and describe the cloaca itself.

It is well known that, externally, one orifice only is seen in the male ornithorynchus, which is to serve for the passage of the solid and liquid excrement, and of the penis. This orifice, situated at about 4¼ inches from the extremity of the tail, opens into a considerable cavity, generally called the *cloaca* †. When this cavity is slit open very carefully, we perceive three orifices of different dimensions, the uses of which are easily discovered. The highest up, which is also the largest, is the extremity of the rectum ‡; the second, at about $\frac{4}{10}$ths of an inch from the former, is the opening of the urinary urethra; and the third, situated close to the former, passes into a sheath, in which the penis is entirely concealed. On the surface of the cloaca, near the termination of the rectum, are five or six small dark-coloured orifices, by which a few very small glands pour their secretions into the cloaca. If the urethra be now laid open from behind, that is, on the side which regards the

* The description taken at the time of the dissection, is as follows:— "These ducts open close to the entrance of the urethra into the bladder, by a narrow linear aperture, the lower edge of which forms a sort of valve."

† It is to be regretted that this name of *Cloaca* was adopted, taken as it is from the class of birds. The same structure exists in the beaver; and hence we see evidently the impropriety of the name "*Monotremes*," given by some French naturalists to the Echidna and Ornithorynchus; under which appellation, they ought also to include the Castor tribe.

‡ The length of the cloaca, from its external orifice to the opening of the rectum, is about $1\frac{5}{10}$th inches.

rectum, and the incision extended to the urinary bladder, there will now appear a circular orifice, situated at about $1\frac{4}{10}$th inches from the opening into the bladder, and precisely $1\frac{8}{10}$th inches from the orifices of the seminal ducts or *vasa deferentia*, which have been already described as entering the urethra close to the orifice of the bladder. The urethra itself is composed, as M. CUVIER well remarks, of a muscular portion only, included chiefly within the pelvis, and wants that which we call vascular. Its length from the openings of the *vasa deferentia* to the cloaca is about $1\frac{7}{10}$th inches; it is united to the lower surface of the rectum, and inclosed with the last by a common constrictor muscle. A layer of muscular fibres, very strong throughout its whole extent, strengthens its parietes. The penis is withdrawn during its relaxed state into a particular pouch, and passes out at the time of erection by an orifice formed in the lower paries of the cloaca, under that which is peculiar to the urine. It is short, nearly cylindrical, and terminated on each side by two small rounded lobes corresponding with the glans penis, each in a great measure covered by its respective prepuce. When this prepuce is opened, four small conical papillæ, or nipples, appear on the surface of either glans. The surface of the penis is extremely rugose, and more particularly the anterior half; these rugosities terminate in very small conical papillæ, which might at first sight be mistaken for small bristles. If the sheath containing the penis be now slit up, the anatomy of the whole parts becomes distinct; the orifice on the lower surface of the urethra is proved to be the opening by which the seminal fluid passes from the common urethra into the canal of the penis, destined for the transmission of the seminal fluid, and that secreted by the glands of Cowper only. To make this evident, we must

refer to the situation of the glands of Cowper, which are placed close to the anus, outside the pelvis, and may readily be discovered by removing the skin of the perinæum, and the muscles by which they are closely enveloped. These glands are comparatively of very large size, a fact readily accounted for, by considering that all the other organs generally found in animals as appendages to the male generative organs, such as prostate, seminal vesicles, accessory vesicles, &c. have disappeared. The duct proceeding from each of these glands is about an inch in length; they unite in a common cavity of small dimension, but distinct, placed close to the urethra, and into which enters the very short canal from the urethra, (whose orifice I have described as situated on the surface of the urethra, at about $1\frac{4}{10}$th inches from the entrance of the urethra into the bladder, and $1\frac{9}{10}$th inches from the termination of the *vasa deferentia* in the common urethra); and from which arises the long seminal canal or urethra of the penis, a duct destined for the transmission of the seminal fluid, and which entirely escaped the notice of the French anatomists. This duct or canal passes through the centre of the penis towards its anterior extremity, but divides, before terminating, into two ducts, destined for the separate bundles of papillæ, in which the bifurcated or double glans of the penis terminates. When the point of one of these papillæ is cut off, it is found to lead into a common cavity placed at the base of the small bundle of papillæ, and into which enters the seminal urethra already described. I now introduced the tube of a syringe into the open orifice of the papilla or nipple-like termination of the glans, which had been cut across, and found that the injected fluid returned by the orifices of the remaining papillæ, which had been left untouched, shewing that the resistance offered by

the seminal urethra contained within the body of the penis was greater than that offered by the papillæ themselves. When the pipe was pushed farther on, so as to enter the branch communicating with the main canal in the body of the penis, the fluid passed out most readily by a small orifice, which had been intentionally made in one of the ducts leading from Cowper's glands, shewing thereby the very free and direct communication between the seminal urethra of the penis and the ducts and glands of Cowper. Having now secured the duct of Cowper, so as to prevent the fluid passing out by the artificial opening, the whole of the fluid injected into the seminal urethra by the open papilla passed readily out by the common orifice on the lower surface of the urethra, the orifice by which the seminal fluid passes from the common urethra, to that contained within the body of the penis; but the fluid passed out in such a way as shewed that it had entered a common cavity, and that having no longer an exit by the ducts of Cowper, it became necessarily effused into the common urethra by the orifice above described. Lastly, having introduced the tube of the syringe into the orifice by which the seminal fluid passes out of the urinary urethra into the little cavity at the base of the penis, and compressing the opening around the nozzle of the tube, the fluid, whether water or quicksilver, readily passed out by all the papillæ situated in either glans of the penis.

The physiology of these very intricate organs becomes now exceedingly simple, and serves to throw considerable light on some of the accessory organs connected with those of generation. The whole of the accessory organs have disappeared, excepting the glands of Cowper,—a fact sufficient of itself to give an importance to these glands, which has hitherto been denied them. But they are moreover

connected with the seminal canal peculiar to the penis itself, and wholly unconnected, or nearly so, with the urinary or true urethra *. The passage and course of the seminal fluid may be readily understood: it is first poured into the common urethra, close to the bladder, by the *vasa deferentia*; passes along this canal, until it reaches the surface of the urethra placed over the base of the penis, and where the opening of the seminal urethra of the penis is placed; the remainder of the urinary canal being shut during erection, partly by muscular contraction, and partly by the efflux of blood into the body and base of the penis, no other passage is left for the seminal fluid, but that opening into the common cavity situated at the base of the penis, and into which are also poured the secretions from the glands of Cowper. But, as fluids readily pass from the ducts of these glands † into the seminal canal of the penis, and *vice versa*, so these secretions are readily transmitted with the seminal fluid along the seminal canal, to the four small conical papillæ situated on either glans, with which this animal is furnished. These papillæ, I have already stated, are hollow, and perforated at their extremity.

The penis is about an inch in length, in its relaxed state,

* In most animals, the ducts of Cowper's glands are so situated as to render it impossible for the seminal fluid to pass along these ducts towards the glands themselves. This is not absolutely the case with the same organs in the ornithorynchus, but I do not think that there arises from this the least doubt relative to the nature of these bodies called Cowper's Glands. I believe them to be essentially glandular; and not receptacles for the seminal fluid, but destined to secrete a fluid of importance in the act of generation.

† By a strange oversight, the hedge-hog is stated in the *Anatomie Comparée*, not to have the glands of Cowper; but the fact is, that they are remarkably large in that animal, whose generative organs merit a more careful analysis than has hitherto been made.

but it is evident that this measurement is not to be depended on. It terminates anteriorly on either side, by four white, conical elastic papillæ, resembling nipples. These may be considered as the terminating points of a double glans, though this, during the relaxed state, is by no means very distinct. When the penis is cut across, or opened into, it is found to possess a structure resembling the usual *corpora cavernosa*, and to be almost entirely composed of numerous vessels of comparatively large caliber. The parietes are dense and strong.

It will no doubt be expected of me, by many of the gentlemen who have done me the honour to listen to this, and to the preceding memoirs, that I should explain how the anatomy of parts apparently easily made out, should have been so singularly misunderstood by the French anatomists; and how, after the observations of Sir Everard Home, which partly coincide with the above, the same errors should have been repeated in the "*Regne Animal*," published so late as 1817; that is, fifteen years after the publication of Sir Everard Home's observations in the Transactions of the Royal Society of London. The answering these questions I consider as a duty I owe as well to the Society before which I read this memoir, as to the distinguished naturalist who intrusted me with the dissection, and who, now for a long time, with unexampled liberality, has forwarded, to the utmost of his power, my researches into comparative anatomy.

To the first question I reply, that the account of the anatomy of the organs of generation in the male Ornithorynchus, contained in the fifth volume of the *Anatomie Comparée*, page 104., could not have been taken from any dissection by the immortal author of that work, but from one performed by an assistant. I shall therefore omit copying it into this memoir, well aware that it will not re-

appear in a second edition of the work alluded to. The following brief account, extracted from the *Regne Animal*, will give a sufficient idea of the extent of the error:—"The third tribe of the *edentata* comprises the animals which Mr Geoffroy designates by the name of "*Monotremes* *," because they have only one external opening for the seminal fluid, the urine, and other excrements. Their organs of generation present extraordinary anomalies. The *vasa deferentia* pass into the urethra, which opens into the cloaca, at the base of the penis, which is solid, and has not even a furrow to conduct the seminal fluid †."

On examining Plate LI., contained in the fifth volume of the *Anatomie Comparée*, we readily perceive the cause of these errors. In Fig. 3. the common urethra is left unopened; and the penis consequently appears without any aperture. The glands of Cowper are depicted with their ducts, but no mention is made of the mode in which they terminate, except by saying that they join the little canal or tube by which the urethra opens into the cloaca. In Fig. 2. the urethra has been opened in such a way as to destroy the entrance of the ducts of Cowper, the cavity into which they pass, and the orifices by which this cavity communicates with the true urethra and with the penis. It is true, that these engravings refer more particularly to the *Echidna*; but we know, from the dissections of others, that these animals do not differ essentially from each other.

It only remains for me to explain how these errors should have been repeated in the *Regne Animal*, published in 1817, and so long after better descriptions of these organs had been given to the world, in the Transactions of

* I have already remarked on the impropriety of this name.

† Tom. I. p. 224.

the Royal Society of London. The only reasons I have yet found out for this omission are, that, in these "Observations," the urethra is said to open into the rectum *, which is not the case; and the two glands of Cowper are described as terminating by six or seven orifices upon the surface of the rectum, instead of which, these canals terminate in a small cavity which communicates with the urethra, and with the seminal canal of the penis. The anatomy and physiology of these glands have been in consequence entirely misunderstood; at the same time, the true situation and anatomy of the orifice by which the seminal fluid passes into the canal or duct of the penis, though described, is not depicted. In a subsequent paper on the anatomy of the Ornithorynchus Hystrix, contained in the same volume of the Philosophical Transactions, most of these errors have been corrected. The true anatomy of the glands and ducts of Cowper had been discovered, and this led to a more accurate description of the whole: but it must be evident, that these seemingly contradictory statements might have led the French naturalists to disregard dissections which, in other respects, were extremely accurate †. I shall endeavour to submit to the Society, at a future period, a few opinions relative to the place which the Ornithorynchus is entitled to, in the scale of animals. In the mean time, it must be evident, that the speculations relative to the analogy of the Ornithorynchus with birds, so far as regards the male organs of generation, are entirely erroneous.

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* Page 79. 1802.

† I have caused drawings of the parts described in this memoir to be laid before the Society, which, in addition to the diagram, and the inspection of the parts themselves, will, I trust, render the anatomy of the whole sufficiently distinct. The engraving (Plate V.) is from a pencil sketch by Mr Thomson.

MEMOIR IV.

On the Osseous, Muscular, and Nervous Systems of the Ornithorynchus paradoxus.

I EXPERIENCED the greatest difficulty in drawing up the following memoir on the bones and muscles, because it is in these, and more particularly in the former, that the Ornithorynchus deviates most from the usual structure of the Mammalia, and approaches nearest to the class of Reptiles. Moreover, in order to have examined the osteology of the head minutely and accurately, it was necessary to have suffered the head to macerate so long as to present all the sutures in their most distinct state. Now, this I was unwilling to risk with the single specimen in my possession. Lastly, it is evident from the state of the bones, and more particularly from the obliteration of the sutures of the cranium, that the animal had arrived at its full growth, and consequently was unfit, in certain respects, for the purpose of osteological inquiries. I was obliged, therefore, to content myself with a general and rather superficial view of these very important organs.

From the previous description of the organs of sense, and from the skeleton which I have the honour to submit to the Society, for the inspection of the members, the general elongated form of the head will be readily understood. The extension of the superior maxillary and intermaxillary bones is very remarkable. The zygomatic arch is broad and strong; but the osseous orbit, as in most other animals, is incomplete. The prolongation of the nares backwards,

and the great comparative size of the superior maxillary bones, seem to me to have lessened the importance of the palate-bones in the formation of the floor of the nostrils, and to have reduced the pterygoid processes of the sphenoidal bones to a rudimentary state, by throwing them out laterally, so that they are articulated with the upper maxillary bones by a hinge-like joint, capable of considerable motion. They are placed horizontally; that is, on the same line with the osseous palate, and are connected with the *malleus* in the manner described in a former memoir.

The cranium is articulated to the spinal column by two large condyles. The cervical vertebræ are seven in number, and thus shew a decided mammiferous character. The *atlas* is very large, and its processes strongly marked. The same observation may be applied to the *dentata*; and, more particularly, to its spinous processes. The remaining cervical vertebræ gradually decrease in size: the development of these vertebræ corresponds with the great strength of the muscles which arise from, or are connected with, their processes. The total number of vertebræ is forty-nine; of which seven are cervical; seventeen strictly dorsal, having ribs implanted into them; one lumbar; three sacral, articulated with the ossa ilii; and twenty-one caudal. The spinous processes of the dorsal vertebræ are much sloped towards the tail. The four anterior dorsal vertebræ have spinous processes on their interior surface, which are strong, of a square form, and gently sloped towards the neck. The same processes in the last dorsal, in the lumbar, and in about one-half the caudal vertebræ, are strong and vertical. In the remaining caudal vertebræ, they gradually decrease in strength, and slope towards the back. The caudal vertebræ strongly resemble those of the beaver, in the length and breadth of the transverse processes, and in having spinous processes placed on their inferior surface.

Of the ribs, which are seventeen in number, the first is attached to the sternum, apparently by cartilage; the succeeding four by bone, the cartilage being removed towards the centre of the rib; the succeeding ten terminate in broad osseous plates, extensively moveable, though connected with each other. Of the two remaining to be described, one is attached by ligament to the preceding rib, but they do not terminate in bony plates, and may be considered as floating ribs.

There is perhaps nothing more singular in the structure of the ornithorynchus, than the formation of the clavicle and scapula, which have altogether the appearance of the same bones in reptiles; and, as seems to me, more particularly in the animal called Tupinambis. From a scarcity of specimens in my possession, I am by no means prepared to enter on the inquiry to which class precisely the bones composing this very complicated clavicle and scapula ought to be referred. We readily distinguish a clavicle composed of a broad flat portion, articulated with the anterior, that is, upper edge of the sternum, and a small horizontal branch, evidently incomplete in its mesial part, and intimately connected with a parallel branch of the flattened portion of the clavicle *. These latter branches are joined with that por-

* The fossil animal described in the Philosophical Transactions for 1818, has a sternum and clavicle very analogous to the Ornithorynchus. This analogy, which has been very beautifully pointed out by Sir E. Home and Mr Clift, is even more perfect than these gentlemen suppose; for I perceive, by the accompanying drawing (Phil. Trans. 1818, Part I. Plate II.) that the two small bones just described by me, as being present in the Ornithorynchus paradoxus, have escaped their observation. Hence the distinguishing marks between the bones composing the sternum and shoulder in these two animals does not consist in the fossil animal having a clavicular bone, which is wanting in the Ornithorynchus paradoxus, but rather in this clavicular bone or *fourchette* being united throughout its whole length with the scapula in the one, and with the clavicle or upper bone of the sternum

tion of the scapula which, from a very obvious analogy, I should call its acromial process. The scapula itself is shaped like that of a bird; and, in addition to its acromial process, by which it is connected to the clavicle, sends a very strong process backwards and inwards, towards the upper bone of the sternum, with which it is articulated: and it is even somewhat connected with the bone which I have called the flat portion of the clavicle. Along the whole inner margin of the process of the scapula joining the sternum (and which bears so great a resemblance to the true clavicle in birds), is placed a thin flat semicircular plate of bone, which, running up behind the broad clavicular bone, performs extensive circular motions during the action of the anterior extremities, as well by reason of the laxity of its connection with the clavicular bones, as by its loose hinge-like joint with the scapula. It is exceedingly difficult to decide on a name for this very singular bone, and to trace its analogies throughout the range of vertebral animals. In the mean time, until that be satisfactorily done, it must be evident, I think, to all, that its analogies ought to be sought for in the class of Reptiles: for, in most species of this class, there would seem to prevail an analogous structure, though occasionally very complex, and with difficulty to be made out. The extreme laxity of the articulation of the scapula in the Ornithorynchus, and its anomalous bone or process,

in the other. There are several other differences sufficiently remarkable. The peculiar flat semicircular bone forms a great portion of the glenoidal cavity in the fossil animal, and the scapula does not seem to be in any way articulated with the sternum, unless we consider the bone marked *b* (see the drawing) as the anterior bone of the sternum. Neither of these circumstances holds with regard to the Ornithorynchus paradoxus. There is a considerable resemblance between the shoulder-bones of the fossil animal and the common Chameleon, a skeleton of which I have placed before the Society.

explain sufficiently its functions; for, by this, the humeral part of either extremities is enabled to approach the other; and thus the whole of the anterior extremities can approximate much more than if the articulation of the lower process of the scapula had been attached to the sternum with the same degree of fixity as the upper or acromial process. In addition to the extensive rotatory motion which the distance of the acromion from the joint enables the humerus, and consequently the extremity, to perform, another kind of motion is performed, by means of a moveable articulation, found only in reptiles and fishes; I mean the sliding semicircular motion performed by the squamous part of the scapula upon the flattened portion of the clavicle *.

Some exceedingly ingenious attempts have been made to reduce the whole assemblage of bones composing the shoulder, clavicle, and sternum of the ornithorynchus to their analogous bones in birds and reptiles, but these attempts have not as yet been very successful, and the reason of this appears to be sufficiently obvious: for the bones of the sternum in reptiles are in general so anomalous as to defy classification, founded on analogy with other vertebral animals; whilst the analogies endeavoured to be established between the same parts in birds, and the mammalia, are by no means generally agreed to. In the ornithorynchus, we find, as it were, a compound of the three classes Mammalia, Aves and Reptilia. The dorsal part of the scapula resembles the same part in birds. The acromial process approaches that of the Mammalia; the glenoid cavity of the joint is placed at the union of the dorsal part of the scapula and the process extending to the sternum, which pro-

* In Plate V., will be found an accurate sketch of the assemblage of bones composing the shoulder and sternum of the Ornithorynchus, accompanied by one of the fossil animal alluded to in the text.

cess bears a close resemblance to the clavicle in birds; whilst the bones I have called Clavicle (three in number) are very analogous to the *fork* or *merry-thought* found in the same class of animals. With regard to the flat, moving, squamous bones situated behind the clavicle, and fixed to the sternal portion of the scapula, it is evident that their analogy is to be found only amongst reptiles. Perhaps, then, we might say, that the scapula has a dorsal plate and acromial and coracoid processes; that the acromial is tolerably regular as to situation and distribution, but that the coracoid, which, in Man, is rudimentary, is, in the Ornithorynchus, extended to the sternum *. We may next suppose the flat and broad portion of what I have hitherto called the clavicle, to be actually the anterior bone of the sternum; which, in this view, would come to be composed of five instead of three bones, placed the one immediately behind the other †, whilst the two thin and long bones firmly united to the anterior extremities of them, might be considered as analogous to the merry-thought in birds ‡. But there still remain to be accounted for, the osseous squamous plates, articulated with what I have just called the coracoid process of the scapula, and which M. St. Hilaire considers as analogous to a small process of bone found immediately at the base of the true clavicle in birds, and to

* I ought to mention here, that that most excellent naturalist, M. Geoffroy St Hilaire, considers the bone we call Clavicle in birds, as the coracoid process of the scapula; which idea is very beautifully supported by the form of the scapula in the Ornithorynchus.

† The fourth of these, counting from the epigastrium, is constantly divided into two in the Ornithorynchus.

‡ These are considered by M. Geoffroy as the acromial processes of the scapula greatly elongated. It is to be remarked, however, that they are connected to the scapula *not by bone*, but by a very perfect moveable articulation, with a capsule,—and I am not sure that M. Geoffroy is aware of this fact.

which he has given the name of "*Os Episternal.*" The principal distinguishing characteristic of this "os episternal," is said to be, that it is placed always on the coracoid process; but this rule does not seem to hold true with regard to the frog, and perhaps with some other reptiles. We are compelled, therefore, to consider these bones as strictly belonging to the class Reptiles, and that their presence in the Ornithorynchus may depend either on the extraordinary anomalies which undoubtedly exist in this animal, or that it is connected with the aquatic habits of the animal, and intended to facilitate the movements of the anterior extremity, and to extend them so far as was consistent with the safety of the shoulder-joint. In short, it seems intended to permit the coracoid process of the scapula considerably to change its position, and to approximate or recede from its fellow, at the will of the animal, and thereby very much to extend the movements of the anterior extremity, and to convert it into an oar of the most perfect description.

It is sufficiently curious, that, whilst so much has been written to prove the analogy of the bones entering into the composition of the sternum, clavicle, and scapula throughout the animal kingdom, no attempt, so far as I know, has been made to name the bones which may be supposed analogous to the marsupial bones of the pelvis, and which are not peculiar to the ornithorynchus, but found in a very considerable number of animals *. The truth is, that these bones are quite peculiar to the class, and created by Nature apparently for a particular purpose, viz. of supporting the marsupium, or abdominal pouch, in which the young of these animals are contained, from the period of their imperfect birth, until they are capable of providing for

* Since writing the above, I find that an attempt has been made to compare the marsupial bones with the *os peniale* found in certain animals, as the dog, &c.

their own wants and safety. Yet these bones are present in the Ornithorynchus and Echidna, which are said not to have a marsupium; and the fact has been brought forward by Professor BLUMENBACH, as a proof of what he calls an "union of the teleological and mechanical principles in the function of generation,—principles which were formerly thought to be incompatible with each other." The formation of this anomalous pair of bones (he observes) for the purpose of supporting the abdominal pouch of the female, is a clear instance of the teleological principle; that is, it shews a peculiar part formed for a certain purpose. Their existence in the male (and of course in the Ornithorynchus) where the end and purpose of their formation do not exist, shews the mechanical principle, as if they had been merely framed in compliance with some general model for the structure of the species *.

The bones of the extremities may be described together, as they so much resemble each other. The *os humeri* is strong, and peculiarly formed with regard to its processes, which are very prominent, and afford a powerful point of attachment to the various muscles; it is perforated near its radial extremity, as in many other animals, for the transmission of bloodvessels. The olecranon of the ulna is much developed, and of considerable breadth. In the posterior extremity, the fibula bears a strong resemblance to the ulna, and has a remarkably strong process for the insertion of muscles extending upwards towards the pelvis and tail. The tarsal and metatarsal and digital bones of the posterior extremities, and the corresponding bones of the anterior extremity, do not require any particular description. We shall therefore only remark, that, in the construction and perfect organisation of the bones of the extremities, the Ornithorynchus differs most remarkably from Birds and Reptiles.

* A Short System of Comparative Anatomy, p. 41.

I intend saying but little on the muscular system, because the muscles being simply the moving powers of the bones, an inspection of the skeleton will readily explain any peculiarities which may exist in the former.

The muscles situated on the neck, connecting the head, trunk, and cervical vertebræ, are very powerful, and seemed to me regular. Those of the back and tail are distributed much as in the Beaver. The marsupial bones have two muscles connected with them, which proceed from their whole inner edge upwards towards the sternum: these may be considered as analogous to the *pyramidales* in man. The *recti*, and other abdominal muscles, are present, and regular. The pectoral muscles, which are divided into two, arise from the whole upper edge and mesial line of the complex clavicles, and from the *linea alba* of the abdomen, nearly as low as the pubis: these muscles are inserted separately into the humerus; the superior or anterior one is perforated by a strong muscle (the deltoid), arising from the dorsum and acromial process of the scapula, to be inserted into the os humeri.

When the external pectoral muscles are removed, two broad muscles are found immediately beneath, arising from the whole surface of the peculiar squamous bone (described at considerable length above, under the name of the Squamous Process of the Scapula;) and inserted the one into the inner tuberosity of the os humeri; the other into the same bone, but much nearer the fore-arm. These may be considered as analogous to the coraco-brachialis of the Mammalia; or we may prefer giving the name of Coraco-brachialis to two long muscles of a rounded form, which arise from the coracoid process itself, and are inserted into the *os humeri*. From the same squamous bone, and from the semicircular edge of the peculiar clavicle, arises a long slip of muscle, which, proceeding downwards, is inserted into the

aponeurosis covering the rectus muscle, nearly midway betwixt the sternum and pubes.

Another short but powerful muscle arises from the whole inner surface of the squamous process of the scapula, and is inserted most extensively into the broad inner surface of the *os humeri*; and close to it is a muscle having a similar origin, but is inserted into the first rib*. The muscles connecting the dorsal portion of the scapula with the spine, and the former with the *os humeri*, are tolerably regular, and at least as numerous as in any of the Mammalia. The extensors of the fore-arm seemed to me powerful: the same observation is applicable to the other muscles of the fore-arm and leg, the extent and nature of whose motions may be judged of, by observing the bones, and, more particularly, the development of the radius and tibia.

The sterno-mastoid is fixed into the small horizontal bone, which M. GEOFFROY calls the acromial process, and into the horizontal branch of the clavicle immediately connected with it. It thus becomes either a sterno-mastoid, cleido-mastoid, or scapulo-mastoid muscle, according to the view adopted relative to these bones: at the same time, the *omo-hyoideus*, which is much more developed proportionally than in the human subject, arises from the scapula, close to where it is connected with the horizontal branch of the clavicle, and following the regular course of the muscle is inserted into the *os hyoides*.

These are all the details relative to the muscles with which I have thought fit to trouble the Society.

The brief account I propose giving the Society of the Nervous System, cannot be expected to be either minute

* From the number and strength of the muscles connected with this anomalous bone, may be judged its importance in the movements of the shoulder, and its influence even over the thorax itself.

or accurate, since I had no opportunity of viewing the brain and spinal marrow, those great central organs of sensation, with which all the nerves of the body, directly or indirectly, communicate; and I could not trace any nerve very completely to its termination, for fear of destroying other important parts.

The first, second, third, fourth, and sixth pairs of cerebral nerves, I either did not see at all, or only in a partial way. I have not the least doubt of their being quite regular in their distribution. The fifth has been already described, whilst speaking of the organs of touch and taste. The auditory nerve was not seen; the facial, which I prefer calling by the name of the *portio dura* of the seventh pair, to any other yet invented, was regular as to its presence and size. Its distribution was chiefly to the cheek-pouches, and back and side of the head, around the external orifice of the ears; but it did not approach the nostrils, for a very obvious anatomical reason, and, consequently, in this animal at least, has nothing to do with the organs of respiration. The eighth, or *par vagum*, the ninth, with the nerve called the *descendens noni*, the spinal accessory, and the cervical portion of the sympathetic nerve, were very strictly as in the Mammalia. I also remarked, that the sympathetic nerve, in its passage down the neck, was more distinctly marked and detached from the *par vagum*, than in many animals supposed to stand much higher in the scale of the animal creation. The superior cervical ganglion was very small, but at this point the sympathetic branch united with the *par vagum*. Immediately above this union the nerves were again distinct, and three branches belonging to the sympathetic nerve could be traced proceeding towards the fifth pair. The inferior cervical ganglion was large, but there did not exist any middle one. The cervical nerves were large and regular. No-

thing struck me more forcibly than this strict accordance of the nervous system with that of the Mammalia in general: the same observation is applicable to the bones and muscles, so that the analogy supposed to exist between the Ornithorynchus and Birds is reduced to the resemblance of the ossicula of the ear, and to the female organs of generation, which I have not as yet had an opportunity of examining.

I could easily have swelled out these memoirs to a much greater length, by entering into the minute anatomical details, which were carefully taken down during the dissection; but I cannot think that these would in the least interest the Society, since they do not lead to any general physiological results.

Explanation of Plate V.

Fig. 1. Gives a front view, from nature, of the complex clavicle and scapulæ of the Ornithorynchus. The bones are represented of their natural size.

a, Marks the upper or anterior bones of the sternum, the Entosternal of Mons. Geoffroy St Hilaire. To these bones the anterior pair of ribs are attached at *a*.

b, The clavicle, (*Furculaire* of M. Geoffroy.)

c, The process of the scapula joining the clavicle, and which I consider, with M. Geoffroy, as analogous to the coracoid process in Man, and the true clavicles in Birds.

d, The glenoid cavity of the shoulder-joint.

e, The peculiar, flat, and highly moveable bone, articulated by a moveable joint, with the coracoid process of the scapula; it passes up behind the clavicle, and its upper or anterior edge may be seen at *e*, *e*. It is this bone which performs an ex-

PLATE V.

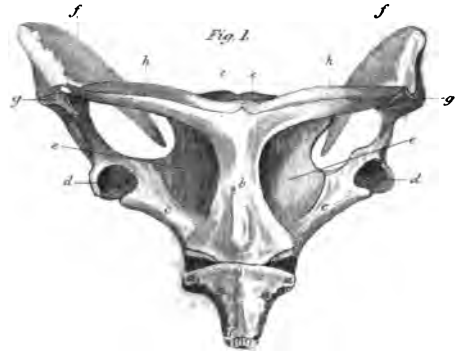


Fig. 1.

Fig. 2.

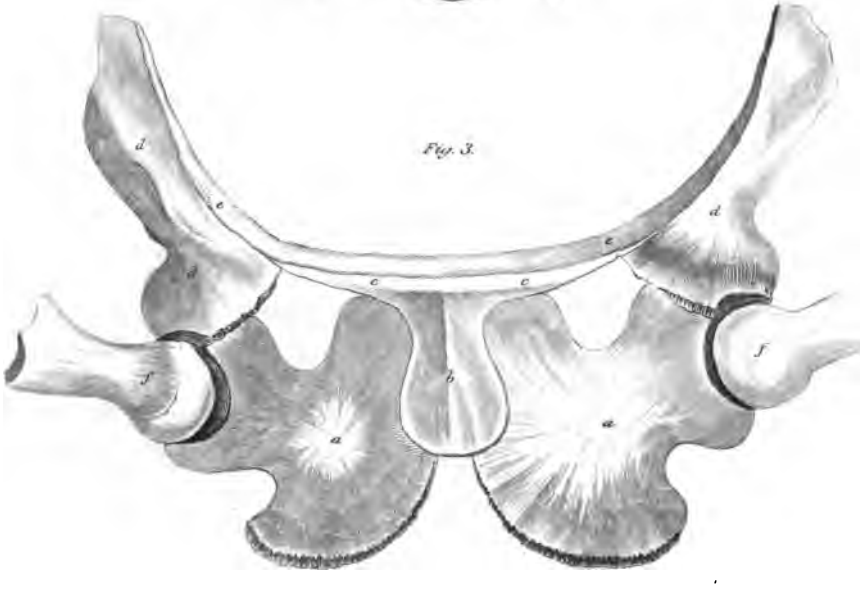


Fig. 3.

tensive sweeping semicircular motion, and thereby enables the whole shoulder to alter very much its relative situation to the clavicle and sternum. It is the episternal of GEOFFROY.

f, The dorsal portion of the scapula.

g, The little process, I have considered in the text as the *acromion* scapulæ. Here there is a moveable articulation of the clavicle *b*, and of two bones marked *h*, *h*, considered by me as analogous to the *fourchette* or *merry-thought* in birds. They are named Acromial Processes by GEOFFROY. They are intimately united to the horizontal branch of the clavicle, and are articulated to the scapula, by means of a joint admitting a certain degree of motion. They have been omitted in the very spirited drawing of this part of the osseous system of the Ornithorynchus paradoxus, by Mr CLIFT, and published in the Philosophical Transactions for 1792.

2. Represents an anterior view of these bones; the letters *h* and *f* refer, as in the preceding figures, to the merry-thought and dorsal portion of the scapula; *i* marks the articulation between these bones at the part I have called *acromion*.

3. Is taken from a figure in the Philosophical Transactions for 1818, Part I. Plate II. It is a representation of the bones entering into the composition of the shoulder, in a fossil animal described in the same work.

a, Two flat bones, peculiar to the sternum of this animal and the Ornithorynchus.

b, A flat bone, behind which is concealed the union of the edges of the two flat bones just mentioned. (This is considered by Sir E. HOME as the sternum of the animal, and is called so at *e*.)

c, c, Two processes from this bone, by means of which it is united to the scapulæ.

d, d, The scapulæ, which, united to the flat bones, form the glenoidal cavities of the shoulder-joints.

e, e, A slender curved bone, crossing the upper end of the sternum, and uniting the scapulæ to each other.

f, Os humeri.

4. Engraved from a pencil sketch, by Mr R. M'Innes, of the organs of generation in the male Ornithorynchus.

a, The testicles.

b, The epididymis.

c, The bladder of urine.

d, The orifices of the seminal vessels (*vasa deferentia*) entering the urethra close to the opening into the bladder.

e, The urethra laid open.

f, The rectum; partly laid open at *g*.

h, The common surface of the cloaca slit up.

i, The opening by which the seminal fluid passes into the canal peculiar to the penis. This opening leads into a small cavity, into which enter the ducts from Cowper's glands, marked *k*, and from which arises the canal of the penis, admitting the seminal fluid, and that from Cowper's glands only.

l, The orifices of a number of small blackish mucous glands, which pour their fluids into the cloaca, close to the entrance of the rectum.

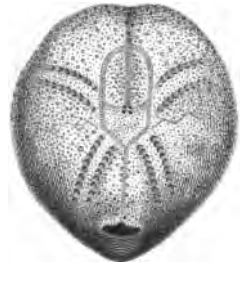
m, The body of the penis.

n, Marks the four small conical papillæ in which each glans terminates: these papillæ are hollow and pervious.

PLATE VI.

Wern. Mem. Vol. V. page 174.

Spatangus ovatus



W.H. Lizars Sculpt

IX.—*An Account of a series of Thermometrical Observations, made hourly at Leith, during Twenty-four Successive Hours, and once every Month, from July* 1822 *to July* 1823.

By Mr John Coldstream.

(*Read* 14*th July* 1823.)

THE best and most valuable plan for the keeping of a thermometrical register, would undoubtedly be, to make observations at the end of short and regular intervals; for instance, every hour, or every two hours: because, the first and main object of the meteorologist, in keeping such registers, being to ascertain the average temperature of each day, as nearly as possible, it is evident, he cannot fix this point better, than by calculating the mean of very frequent observations, which will, of course, always approach nearer and nearer to the true average temperature of the whole twenty-four hours, in proportion to the number of observations.

However desirable the accomplishment of such a plan might be, yet its inconvenience, nay, general impracticability, is abundantly obvious.

It becomes, therefore, a matter of no small moment, to find out, at what hour or hours, the average temperature of the day, for the most part, occurs; that the meteorologist may be furnished with accurate information, for the proper conducting of his observations, and a long-agitated question in physical science, finally answered.

During those ages which immediately followed the invention of the thermometer, philosophers were guided by mere whim and caprice, in settling their hours for observing the indications of that instrument. But, since the great subject of the mean temperature of the globe has been started for discussion, and since the high importance of meteorological registrations to the best interests of mankind has been generally acknowledged, men of science have all agreed in admitting the necessity there is for their observations being at least synchronous one with the other. This is, however, not sufficient for the purposes of philosophy. If the mean temperature of the day is not ascertained by all, the synchronism of the observations matters but little. Many different hours have been proposed as the best suited for the attainment of the object desired, but perhaps too frequently on unstable grounds. After the maximum and minimum thermometers had deservedly come into general use, the hours of 10 A. M. and 10 P. M. were confidently stated as the preferable ones for observation; the mean of these agreeing with the mean of the extremes indicated by the instruments alluded to; that, again, being supposed by many, palpably to demonstrate the true average temperature of the twenty-four hours.

The only mode, however, that can be adopted, definitively to settle the disputed point, plainly is, to make a continued series of observations for a considerable period of time, at the lapse of very short intervals,—as for two or three years, at the end of every half hour, day and night,—

a task that might be accomplished, in particular situations, by the co-operation of many, although it never could be done by a single individual.

As far as our information extends, a prolonged series of this kind has never been instituted in Britain; but it is proposed, at present, to give an account of such a set of observations, on a small scale, lately carried on in Leith, and which have been productive of results, that prove well the interest and importance of the subject.

In the twelfth number of the Edinburgh Philosophical Journal, Dr BREWSTER, at the conclusion of some remarks on a set of like observations carried on by Dr DEWEY, at Williamston, in the United States of America, mentioned, that "it would be desirable to possess a series of observations made in Scotland for every hour of the day, for a small number of days;" and that "he begged leave earnestly to suggest such a series of experiments, to some of those active meteorologists who have undertaken to keep regular registers of the thermometer in Scotland *."

Immediately on reading the above quoted suggestion, I set about a series of hourly observations, and continued them for six successive days, beginning on the 1st April 1822. Not being so well satisfied with the manner in which this series was conducted, I take no notice at present of the results obtained. Soon after, I began those observations which form the subject of the present communication. I proposed to myself to observe the thermometer for twenty-four successive hours every month, commencing on the 1st July, and this plan, with the occasional assistance of a friend, I continued regularly throughout the year.

The following is a copy of the journal of this series.

* It appears from the notice of Dr DEWEY's paper, here alluded to, that he observed for thirty days, at different times of the year, twenty-four times a-day.

JUNE 30.—JULY 1. 1822.			AUGUST 1. 1822.		
HOUR.	THER.	WEATHER, &c.	HOUR.	THER.	WEATHER, &c.
	°			°	
8 P. M.	57,0	Dullish; strong wind.	1 A. M.	48,0	Clear, fine. Moon obsc.
9 —	56,0	Do. do. pleasant.	2 —	48,0	Rather dull.
10 —	56,0	Wind incr.; large cum.	3 —	47,0	Clear cloudless dawn.
11 —	54,0	Dull; do. do.	4 —	46,0	Very fine, sunshine.
12 —	52,5	Do. do. do.	5 —	46,0	Do. do.
1 A. M.	52,5	Do. do. do.	6 —	48,0	Do. do.
2 —	52,0	Clear dawn; very fine.	7 —	52,0	Do. do.
3 —	51,0	Do. do.	8 —	54,0	Do. do.
4 —	52,0	Sunshine, wind incr.	9 —	56,0	Do. do.
5 —	52,0	Do. very fine.	10 —	57,0	Do. do.
6 —	54,0	Rather dull.	11 —	59,5	Do. do.
7 —	56,0	Fine, pleasant.	12 —	64,0	Cloudy, dull.
8 —	58,0	Dullish.	1 P. M.	64,0	Sunshine.
9 —	60,0	Bright sunshine, fine.	2 —	62,0	Cloudy; very pleasant.
10 —	62,0	Do. do.	3 —	67,5	Bright sunshine.
11 —	63,5	Dullish.	4 —	69,0	Do.
12 —	63,0	Cloudy, pleasant.	5 —	67,2	Cloudy.
1 P. M.	64,0	Do. do.	6 —	63,0	Sunshine.
2 —	64,0	Do. do.	7 —	62,0	Do.
3 —	64,0	Do. do.	8 —	58,0	Do.
4 —	69,0	Fine sunshine.	9 —	56,0	Clear, pleasant.
5 —	64,0	Do. do.	10 —	54,0	Bright moonshine.
6 —	63,0	Do. do.	11 —	51,5	Do.
7 —	60,0	Dullish, very pleasant.	12 —	48,5	Do.

RESULTS.

1. Average temperature of the 24 hours, - - 58,31+
2. Maximum (at 4 p. m.) 69,00
3. Minimum (at 3 a. m.) 51,00
4. Range of observed temp. 18,00
5. Mean of the extremes, 60,00
6. Average rise per hour, 2,10
7. Average fall do. - 2,62
8. Average temperature of the day occurred at 8 a. m. and 8 p. m.

NOTE—Sun rose at 3 h. 20 min. a. m.
set 8 h. 46 min. p. m.

RESULTS.

1. Average temperature of the 24 hours, - - 56,17+
2. Maximum (at 4 p. m.) - 69,00
3. Minimum (at 4 a. m.) - 46,00
4. Range of observed temp. - 23,00
5. Mean of the extremes, - 57,50
6. Average rise per hour, - 2,318
7. Average fall do. - - 2,336
8. Average temperature of the day occurred at 9 a. m. and 9 p. m.

NOTE—Sun rose at 4 h. 5 min. a. m.
set 8 h. 7 min. p. m.

SEPTEMBER 2. 1822.			OCTOBER 1. 1822.		
HOUR.	THER.	WEATHER, &c.	HOUR.	THER.	WEATHER, &c.
1 A. M.	60,0°	Clear moonshine.	1 A. M.	50,0°	Dullish, moon obsc.
2 —	60,5	Dull; flying cumuli.	2 —	50,5	Do. do.
3 —	60,5	Do., wind incr., SW.	3 —	51,0	Do. do.
4 —	60,0	Dullish, pleasant.	4 —	50,0	Do. do.
5 —	60,0	Very pleas., wind str.	5 —	49,8	Do. do.
6 —	60,5	Dullish, fine.	6 —	50,0	Do. do.
7 —	61,0	Do. do.	7 —	50,0	Sunshine.
8 —	61,0	Do. do.	8 —	52,4	Dull. Cumuli.
9 —	64,0	Bright sunshine.	9 —	54,0	Very dull. Wind E b N.
10 —	66,0	Do.	10 —	53,8	Do. do.
11 —	66,0	Do.	11 —	54,0	A little rain.
12 —	64,0	Dull, windy, not unpl.	12 —	56,0	Dullish, pleasant.
1 P. M.	63,0	Do. do.	1 P. M.	57,5	Do. do.
2 —	64,0	Do. do.	2 —	58,0	Do. do.
3 —	66,5	Sunshine, fine.	3 —	56,5	Do. do.
4 —	65,0	Rather dull.	4 —	56,0	Clear, fine.
5 —	60,0	Do.	5 —	54,0	Dullish; strati.
6 —	58,0	Do. Wind abated.	6 —	53,5	Do. do.
7 —	56,5	Dullish, fine.	7 —	53,0	Do. intervals of sunsh.
8 —	56,0	Moon obscured.	8 —	52,0	Very fine, moon bright.
9 —	54,1	Clear & bright moonsh.	9 —	52,0	Do: dull at intervals.
10 —	54,0	Do. do.	10 —	52,0	Do. clear moonshine.
11 —	53,0	Dullish, fine.	11 —	50,5	Do. do.
12 —	53,0	Clear moonshine.	12 —	49,8	Do. do.

RESULTS.

1. Average temperature of the 24 hours,	60,27+
2. Maximum (at 3 p. m.)	66,50
3. Minimum (at 11 p. m.)	53,00
4. Range of observed temper.	13,50
5. Mean of the extremes,	59.75
6. Average rise per hour,	1,42+
7. Average fall per do.	4,6
8. Average temperature of the day occured at 6 a. m. and 5 p. m.	

NOTE—Sun rose at 5 h. 7 min. a. m
set 6 52 p. m.

RESULTS.

1. Average temperature of the 24 hours,	52,75
2. Maximum (2 p. m.)	58,00
3. Minimum (5 a. m.)	49,80
4. Range of observed temper.	8,20
5. Mean of the extremes,	53,90
6. Average rise per hour,	1,04
7. Average fall per hour,	0,92
8. Average temperature of the day occurred at 8 a. m. and 8 p. m.	

NOTE—Sun rose at 6 h. 4 min. a. m.
set 5 36 p. m.

November 1. 1822.			December 1. 1822.		
HOUR.	THER.	WEATHER, &c.	HOUR.	THER.	WEATHER, &c.
1 A. M.	52,0°	Dullish; strati.	1 A. M.	39,5°	Very heavy rain, very
2 —	49,5	Clear moonshine.	2 —	40,0	Do. do. [dull
3 —	50,0	Clear, wind increas.	3 —	40,0	Do. do.
4 —	49,0	Do. do.	4 —	40,0	Do. do.
5 —	48,0	Do. do.	5 —	41,0	Rain abated. Wind W.
6 —	48,0	Dullish.	6 —	40,0	Fair, wind continuing.
7 —	50,0	Do.	7 —	41,0	Do.; dullish
8 —	52,0	Clear sunshine.	8 —	41,0	Do. do.
9 —	54,5	Dullish, fine.	9 —	40,0	Clear, cumulo-strati
10 —	56,0	Do. do.	10 —	45,0	Do.
11 —	56,5	Do. do.	11 —	44,0	Do. cirri, windy.
12 —	57,0	Do. do.	12 —	44,0	Dullish.
1 P. M.	58,0	Fine, interr. sunshine.	1 P. M.	44,5	Bright sunshine.
2 —	59,0	Dull, strat.	2 —	42,0	Rather dull.
3 —	59,5	Dullish, wind blowing	3 —	42,0	Clear, pleasant.
4 —	59,5	[hard from SW.	4 —	42,0	Dullish.
5 —	58,5	Do.; a little rain.	5 —	41,0	Do.
6 —	58,0	Do., wind increasing.	6 —	40,0	Do.
7 —	59,0	Intervals of moonsh.	7 —	39,5	Do.
8 —	59,5	Do. wind very strong.	8 —	39,5	Do.
9 —	60,5	Do. do.	9 —	39,0	Do. wind rather str.
10 —	60,5	Do. do.	10 —	39,5	Do.
11 —	60,0	Do. do.	11 —	40,0	Do.
12 —	60,0	Do. wind boisterous.	12 —	39,0	Do.

RESULTS.

1. Average temperature of the 24 hours, - - - 55,64°+
2. Maximum (9 p. m.) - 60,50
3. Minimum (5 a. m.) - 48,00
4. Range of observed temp. 12,50
5. Mean of the extremes, - 54,25
6. Average rise per hour, - 1,29
7. Average fall per hour, - 1,07
8. Average temperature of the day occurred at 10 a. m.

NOTE—Sun rose 7 h. 9 min. a. m. set 4 h. 19 min. p. m.

RESULTS.

1. Average temperature of the 24 hours, - - - 40,97°
2. Maximum (1 p. m.) - 44,50
3. Minimum (9 p. m.) - 39,00
4. Range of observed temp. 5,50
5. Mean of the extremes, - 41,75
6. Average rise per hour, - 1,28
7. Average fall per hour, - 0,94
8. Average temperature of the day occurred at 8 a. m. and 5 p. m.

NOTE—Sun rose 8 h. 11 min. a. m. set 3 h. 28 min. p. m.

JANUARY 1. 1823.			FEBRUARY 1. 1823.		
HOUR.	THER.	WEATHER, &c.	HOUR.	THER.	WEATHER, &c.
1 A. M.	32°,0	Dull; wind gentle.	1 A. M.	36°,5	Very dull, wind str.
2 —	32,0	Do. do.	2 —	36,5	Do. wind E.
3 —	32,0	Do. do.	3 —	36,5	Do. wind rising.
4 —	32,0	Do. do.	4 —	36,5	Do. do.
5 —	31,5	Do. do.	5 —	36,5	Do. wind very strong.
6 —	28,0	Clear moonshine, fine.	6 —	37,0	Do.
7 —	28,0	Do.	7 —	38,0	Dull.
8 —	28,0	Do. sunshine, pleasant	8 —	38,0	Do.
9 —	29,0	Do. do.	9 —	36,0	Do.
10 —	30,0	Do. do.	10 —	36,0	Large nimbi from E.
11 —	32,0	Dullish, pleasant.	11 —	36,0	Unpleasant, wind str.
12 —	33,0	Do. do.	12 —	34,0	Do.
1 P. M.	34,0	Do. do.	1 P. M.	36,0	Very dull, showers of
2 —	34,0	Do. do.	2 —	35,5	snow from the E.
3 —	34,0	Sunshine at intervals.	3 —	35,0	
4 —	34,0	Very dull, not unpleas.	4 —	34,0	Dreadful storm.
5 —	34,0	Do. do.	5 —	34,0	Do.
6 —	34,0	Do. rather disagreeable.	6 —	34,0	Do.
7 —	34,0	Do. do.	7 —	34,0	Do.
8 —	34,0	Do. wind increasing.	8 —	34,0	Do.
9 —	34,0	Do. do.	9 —	34,0	Do.
10 —	34,0	Do. unpleasant.	10 —	34,0	Do.
11 —	33,5	Do. do.	11 —	33,0	Do.
12 —	33,5	Do. do.	12 —	33,0	Do. snow drifting.

RESULTS.

1. Average temperature of the 24 hours, - - - 32°,27+
2. Maximum (1 p. m.) - 34,00
3. Minimum (6 a. m.) - 28,00
4. Range of observed temp. 6,00
5. Mean of the extremes, - 31,00
6. Average rise per hour, - 1,20
7. Average fall per hour, - 1,50
8. Average temperature of the day occurred at many hours.

NOTE—Sun rose 8 h. 34 min. a. m.
set 3 h. 34 min. p. m.

RESULTS.

1. Average temperature of the 24 hours, - - - 35°,3
2. Maximum (8 a. m.) - 38,00
3. Minimum (12 p. m.) - 33,00
4. Range of observed temp. - 5,00
5. Mean of the extremes, - 35,50
6. Average rise per hour, - 1,50
7. Average fall per hour, - 1,16
8. Average temperature of the day occurred at 11 a. m., 2 p. m.

NOTE - Sun rose 7 h. 58 min. a. m.
set 4 h. 30 min. p. m.

March 3. 1823.			April 7. 1823.		
HOUR.	THER.	WEATHER, &c.	HOUR.	THER.	WEATHER, &c.
1 A. M.	43,0	Very dark; windy.	1 A. M.	40,5	Very dark, not unplea-
2 —	42,5	Do. do.	2 —	41,0	[sant.
3 —	42,0	Do. do.	3 —	40,0	Do. do.
4 —	42,0	Do. wind abated.	4 —	41,5	Dull; cloudy.
5 —	41,5	Dullish, not unpleasant	5 —	40,0	Very splendid dawn.
6 —	40,0	Do.	6 —	40,0	Clear sunshine.
7 —	42,0	Fine; dim sunshine.	7 —	40,0	Very fine.
8 —	42,0	Dull.	8 —	44,0	Do.
9 —	43,0	Pleasant.	9 —	46,0	Do.
10 —	44.5	Fine sunsh., pleasant.	10 —	46,0	Do.
11 —	45,0	Rather dull.	11 —	50,0	Cloudy, very pleasant.
12 —	45,0	Dullish, fine.	12 —	50,0	Do.
1 P. M.	46,0	Fine.	1 P. M.	52,0	
2 —	50,0	Dullish.	2 —	52,0	Fine sunshine.
3 —	50,0	Do.	3 —	52,0	Do.
4 —	51,0	Do. wind increasing.	4 —	54,0	Do.
5 —	50,0	Do.	5 —	52,0	Do.
6 —	50,0	Str. gale. Bar. 29.07.	6 —	49,5	Do.
7 —	45,0	Do.	7 —	45,0	Very fine, clear, starry.
8 —	42,0	Wind increasing.	8 —	44,0	Do. do.
9 —	39,5	Dull; no rain.	9 —	43,5	Do. do.
10 —	39,0	Do.	10 —	41,5	Do. do.
11 —	38,0	Blowing a very stiff	11 —	40,5	Do. do.
12 —	38,0	[gale.	12 —	40,0	Do. do.

RESULTS.

1. Average temperature of the 24 hours, - - - 43,79
2. Maximum (4 p. m.) - 51,00
3. Minimum (12 p. m.) - 38,00
4. Range of observed temp. - 13,00
5. Mean of the extremes, - 44,50
6. Average rise per hour, - 1,57
7. Average fall per hour, - 1,50
8. Average temperature of the day occurred at 9 a. m. and 8 p. m.

NOTE—Sun rose 6 h. 50 min. a. m.
set 5 h. 34 min. p. m.

RESULTS.

1. Average temperature of the 24 hours, - - 45,18+
2. Maximum (4 p. m.) - 54,00
3. Minimum (5 a. m.) - 40,00
4. Range of observed temp. 14,00
5. Mean of the extremes, - 47,00
6. Average rise per hour, - 2,28
7. Average fall per hour, - 1,70
8. Average temperature of the day occurred at 8 a. m. and 7 p. m.

NOTE—Sun rose 5 h. 19 min. a. m.
set 6 h. 46 min. p. m.

MAY 3. 1823.			JUNE 4. 1823.		
HOUR.	THER.	WEATHER, &c.	HOUR.	THER.	WEATHER, &c.
1 A. M.	48,0°	Clear, very fine.	1 A. M.	42,5°	Fine dawn.
2 —	46,0	Do. do.	2 —	43,0	Do. very beautiful.
3 —	46,0	Do. do.	3 —	44,0	Do.
4 —	45,0	Fine sunshine.	4 —	45,0	Do. bright sunshine.
5 —	44,5	Extremely pleasant.	5 —	46,0	Do. do.
6 —	48,0	Do.	6 —	48,0	Very fine.
7 —	50,0	Do.	7 —	51,0	Do.
8 —	50,0	Do. wind E. gentle.	8 —	52,0	Dullish, pleasant.
9 —	52,0	Do.	9 —	55,0	Do. do.
10 —	53,0	Do.	10 —	56,5	Do. do.
11 —	56,0	Do.	11 —	56,0	Do. do.
12 —	57,0	Very fine uninterrupt-	12 —	59,5	Dull, not unpleasant.
1 P. M.	57,0	[ed sunshine.	1 P. M.	58,5	Do.
2 —	57,0	Do. do.	2 —	60,0	Fine sunshine.
3 —	58,5	Do. do.	3 —	64,5	Do.
4 —	61,0	Do. do.	4 —	62,0	Dullish.
5 —	58,0	Do. do.	5 —	60,0	Sunshine, very fine.
6 —	53,5	Do. do.	6 —	60,0	Do. do.
7 —	51,5	Very fine, clear.	7 —	58,0	Do. do.
8 —	48,0	Do. do.	8 —	54,0	Do. do.
9 —	48,0	Do. no.	9 —	50,0	Clear, fine, few clouds.
10 —	46,0	Do. do.	10 —	48,5	Do. do.
11 —	45,0	Do. do.	11 —	48,0	Do. do.
12 —	45,0	Do. do.	12 —	47,0	Do. do.

RESULTS.

1. Average temperature of the 24 hours, - - 51,00°
2. Maximum (4 p. m.) - 61,00
3. Minimum (5 a. m.) - 44,50
4. Range of observed temp. - 16,50
5. Mean of the extremes, - 52,75
6. Average rise per hour, - 2,06
7. Average fall per hour, - 2,31
8. Average temperature of the day occurred at 8 a. m. and 7 p. m.

NOTE—Sun rose 4 h. 16 min. a. m. set 7 h. 38 min. p. m.

RESULTS.

1. Average temperature of the 24 hours, - - 52,87+°
2. Maximum (3 p. m.) - 64,50
3. Minimum (1 a. m.) . 42,50
4. Range of observed temp. 22,00
5. Mean of the extremes, - 57,50
6. Average rise per hour, - 1,95
7. Average fall per hour, - 1,80
8. Average temperature of the day occurred at 8 a. m. and 8 p. m.

NOTE—Sun rose 3 h. 22 min. a. m. set 8 h. 33 min. p. m.

The results of the preceding journal I shall now state, confining myself at present to the recording of the simple facts as they appeared on calculation. Dr BREWSTER suggested to me the best mode of drawing the most interesting results, which I followed with all possible care and attention.

Having taken the averages of each twenty-four hours' observations (which were as follows):—

1822,	July,	58.31+
	August,	56.17+
	September,	60.27
	October,	52.75
	November,	55.64+
	December,	40.97+
1823,	January,	32.27
	February,	35.33+
	March,	43.79+
	April,	45.18+
	May,	51.00
	June,	52.87+

and the mean of these, (which proved to be 48°.71+), I calculated the average temperature of each hour in the twenty-four, as it occurred throughout the twelve divisions of the series. This gave

1 A. M. 45.37+	9 A. M. 49.12+	5 P. M. 52.76+
2 — 45.12+	10 — 50.48+	6 — 51.33+
3 — 45.0	11 — 51.54+	7 — 49.75
4 — 44.91+	12 — 52.20+	8 — 48.17—
5 — 44.73	1 P. M. 52.87+	9 — 47.00+
6 — 45.29+	2 — 53.12+	10 — 46.58+
7 — 46.58+	3 — 54.16	11 — 45.67—
8 — 48.17—	4 — 54.67—	12 — 45.07—

The mean of these temperatures, again, is 48°.73+ varying only .02+ from the mean of the whole, obtained by taking the average of the mean temperature of each twenty-four hours' observations. In this manner, I got data for future calculations, the final results of which I shall now state. In doing so, I propose to use the mean

temperature of the whole observations, as derived by the last mentioned plan, for the general standard of comparison.

It was,							48.73+
Mean of the maximum and minimum averages,							49.69+
—	—	—	1 a. m.	and	1 p. m.,	.	49.12
—	—	—	2 a. m.	—	2 p. m.,	.	49.12
—	—	—	3 a. m.	—	3 p. m.,	.	49.58
—	—	—	4 a. m.	—	4 p. m.,	.	49.83+
—	—	—	5 a. m.	—	5 p. m.,	.	48.74+
—	—	—	6 a. m.	—	6 p. m.,	.	48.31
—	—	—	7 a. m.	—	7 p. m.,	.	48.16+
—	—	—	8 a. m.	—	8 p. m.,	.	48.16+
—	—	—	9 a. m.	—	9 p. m.,	.	48.06+
—	—	—	10 a. m.	—	10 p. m.,	.	48.53+
—	—	—	11 a. m.	—	11 p. m.,	.	48.60
—	—	—	12 noon	—	12 midnight,	.	48.63
—	—	—	7 a. m. 2 p. m. and 9 p. m. *,				48.90+
—	—	—	8 a. m. 1 p. m.	—	6 p. m. †,		50.79+
—	—	—	7 a. m. 1 p. m.	—	10 p. m ‡,		48.68+
—	—	5 a. m. 10 a. m. 3 p. m. and 10 p. m.,					48.74+

Here, then, are many hours which afford a near approximation to the average temperature assumed as the standard of comparison; and many others might be combined to give the same result; but this were needless.

From what has been already recorded, it appears, finally,

First, That no single hour approaches, more nearly, in its temperature, to the true average temperature of the day, than does eight in the morning, or eight in the evening, (for, according to the preceding calculations, their temperatures seem to be exactly the same). The difference between the true mean of the day, and the temperature at eight o'clock, was about $\frac{57}{100}$ of a degree.

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* Hours proposed by Dr Dawey.

† Hours proposed by the Philosophical Society of New-York.

‡ Hours which I myself found to approach nearer, in their mean temperature, than any other three hours, to the average temperature of the day.

Secondly, That the mean of the maxima and minima differs $\frac{08}{100}$ from the average of the twenty-four hours. (The mean of the means of the maxima and minima which occurred during the series was 49°.28 varying only $\frac{64}{100}$ from the standard of comparison.)

Thirdly, That of the averages of the temperatures of two hours, those of 5 A. M. and 5 P. M. noon and midnight, 11 A. M. and 11 P. M., 10 A. M. and 10 P. M. approach nearest to the mean of the day. The average of 5 and 5, differing from it only $\frac{11}{100}$ of a degree; of 12 and 12, $\frac{1}{10}$; of 11 and 11, $\frac{15}{100}$; of 10 and 10, $\frac{1}{5}$.

Fourthly, That of the averages of the temperatures of three hours, those of 7 A. M., 1 P. M. and 10 P. M., approximate most closely to the average of the whole twenty-four, the mean of the former differing $\frac{1}{20}$ from the latter.

Fifthly, Of all the combinations of hours I tried, none gave the true mean temperature of the day so well as the mean of 5 A. M. 10 A. M. 3 P. M. and 10 P. M., which corresponded with the average of the day within $\frac{5}{1000}$ of a degree.

Such are the simple facts regarding the most important results to be obtained from this series of observations:—I abstain from farther remarks at present, and shall now conclude by mentioning the other results, less important, derived from the same source.

1. At an average, the maximum of temperature occurred at 4 P. M. and the minimum at 5 A. M.

2. The average daily range was 9.93, its maximum being 23°, which happened in August. Its minimum 5° in February.

3. The temperatures of 7 A. M. and 10 P. M. were exactly the same.

LEITH,
July 1823.

X.—*Notice of a "Journal of a Voyage from Rio de Janeiro to the Coast of Peru, by Mr* WILLIAM JAMESON, *Surgeon, Corresponding Member of the Wernerian Natural History Society.*"

By G. A. WALKER ARNOTT, Esq. A. M. F. R. S. E. M. W. S., &c.

(*Read 26th April* 1823.)

"ON the evening," says Mr JAMESON, "of the 9th March 1822, we re-embarked on board the Fifeshire Packet, having determined to go to sea early the following morning. At 4 o'clock A. M. we accordingly got under-weigh, and proceeded down the harbour of Rio de Janeiro. At 7, the land-breeze having failed, and the tide setting against us, we were obliged to anchor abreast of Porto Fogo Bay. At 10, the sea-breeze having, as usual, commenced, we again got under-weigh, and cleared the entrance of the harbour, after making several short tacks. Wind ESE. At 4 P. M. passed Round Island. Evening, light variable winds, occasionally calm."

On the 20th, having reached Lat. 35° 23′, and Long. 51° 20′, Mr JAMESON appears to have commenced observations, which he continued during the voyage, once a day, on the temperature of the sea; and at 10 in the morning, and the same hour in the evening, on that of the air. The hygrometer (LESLIE's) was not forgot. Of the states of these, a very neat table is given at the close of the Journal.

On the 26th, they "passed many floating bunches of *Fucus giganteus*," (*Macrocystis pyrifera* of AGARDH's

Species Algarum); several Albatrosses (*Diomedea exulans*) were also seen. Lat. 39° 20′, Long. 54° 13′.

On the 27th, "Moderate breezes from NE., with clear weather. Passed considerable quantities of *Fucus giganteus* *. At 10 A. M. temperature of the air 58°, ocean 52°, hygrometer 15°.5, barometer 28°.27. Evening, strong breeze.

"Here several currents exist; for we frequently observed the sea, within a limited distance, as smooth as a river, with a rippling on the surface. Temperature of the air at 10 P. M. 58°, humidity 8°.5. Lat. by observations at noon 41° 10′ S., Long. by chronometers, 56° 17′ W., and by dead reckoning 56° 24′."

"28th. Strong westerly breeze, with a clear and cloudless sky. The surface of the sea presents the same appearance as yesterday; and, indeed, the existence of a current from the southward is evinced, 1*st*, By the daily and progressive difference of longitude, as afforded by the daily range and chronometers; 2*d*, By the sudden diminution in the temperature of the water, being no less than 23°, and, *lastly*, By the very great quantities of floating *Fucus giganteus*, which vegetates only in high southern latitudes. The influence of the current is not felt beyond the parallel of 40° S., for it is there checked in its progress by the coast of Paraguay extending NW. and SE., as well as by an opposite current flowing from the entrance to the Rio de la Plata. A new impulse is thus communicated, which will occasion the current to take a westerly direction.

"Temperature of the ocean 53°, air 59°, hygrometer 14°.5. A great many moths (*Phalænæ*) were driven on board during the day. Wind WSW., strong. Long. by chronometers 58° 20′, and by dead reckoning 59° 7′; Lat. by

* The terminal part of the frond of this Fucus appears to be invariably confluent.

observations at noon 42° 45′ S. Evening clear, occasionally squally. Temperature of the air 55°, humidity 9°.5."

On the 29th, several penguins (*Aptenodytes*) were seen, but Mr JAMESON does not mention what species. Lat. 43° 35′. Long. 58° 50′.

30th. " Temperature of the ocean 48°.8. Still passing quantities of floating *Fucus*. Albatrosses, and three different species of petrels (*Procellariæ*), flying about." Lat. 44° 31′. Long. 59° 44′."

On the 2d April they " passed much *Fucus*," and on the 3d in Lat. 48° 50′, Long. 62° 1′, " sounded in 80 fathoms, fine green sand; saw many whales, and great numbers of oceanic birds, apparently petrels."

On the 5th they were in the parallel, and a little west, of Falkland Islands, and saw many petrels.

6th. A " light air from the NNE., with a clear atmosphere. Sea very smooth, and teeming with vast numbers of a species of cancer (*Asiacus*), of a dark-red colour, and about an inch in length. This remarkable appearance we observed for about an hour, the vessel sailing at the rate of two knots." Lat. 52° 25′. Long. 64° 9′. Mr JAMESON has added on the margin of his journal a sketch of this species of *Cancer*, from which, if correct, it appears to have only six legs: in this respect it differs essentially, not only from the reduced genus *Cancer* of LEACH, but from every division and genus in the order *Macroura* of the subclass *Malacostraca* in the *Annulosæ*. All the known divisions of the *Macroura* have at least ten legs: to this order it must, however, certainly be referred, its tail being furnished with appendices at the extremity.

On the 7th, " At 8 A. M., Cape St John, the most easterly point of Staten Island, bore SSE., distant 15′. The northern coast of this island, about New Year's Harbour, is very mountainous, with peaked summits. Although late in the season, no trace of snow could be observed; and indeed, the sides of the mountains exhibited in many places

an appearance of verdure."—"A strong current appears to set round the east point of Staten Island, the sea being very turbulent and broken." Several penguins, Cape pigeons, and fulmars, were seen.

On the 13th, Lat. 57° 57′, Long. 64° 43′, he remarks, that "two species of the petrel tribe, *Procellaria glacialis* and *Pr.* , were very common: the former is well known; but the latter is seldom, I believe, seen in the Atlantic Ocean beyond the parallel of 30° S." We have to regret that the species is not mentioned.

On the 22d, 23d, 24th, 26th, and 28th, they experienced occasional showers of snow: this was betwixt Lat. 58° and 56°. On the 28th a luminous meteor was observed at the mast head, and much lightning in the SW.

May 8th. Lat. 38° 24′, Long. 83° 34′, they were again surrounded by numbers of the oceanic birds (*Procellariæ*).

On the 11th, they passed about 20 miles to the west of the little island of Massafuero, to the north of which they reached about half a degree the next day. Here Mr JAMESON remarks, that "those birds named Cape Pigeons (*Procellaria*) begin to diminish in number."

On the 16th, Lat. 27° 53′, Long. 75° 35′, they saw some sea-weed, and a few birds, "probably of the genus *Pelecanus*."

On the 18th, Lat. 24° 47′, Long. 73° 36′, they passed some "floating patches of *Fucus*." Several small birds (*Procellariæ*), flying-fish (*Exocœtus volitans*), and a small species of the cuttle-fish (*Sepia*), were observed.

"20th. Light SE. breeze, and cloudy. This morning we had a nearer view of the coast. Its surface is very irregular, without the least appearance of vegetation. A very high mountain, named Morro de Mexillones, rises to a great elevation. A few altitudes of the sun's lower limb, with the corresponding times, as indicated by the chronometers, gave for their mean longitude 70° 38′ 4″ W., a very near approximation to the true place of the ship.

At 12, Lat. by observation 22° 54′ S. Temperature of the sea 68°.5. At 4 o'clock P. M., being about 12 miles to the NW., the colour of the sea had changed from a dark-blue to a bottle-green. Temperature 65°, a difference of 3°.5, distance from the coast about 20 miles. At 4, altered our course to NE., with the intention of entering the port of Cobijo. At 8 P. M. hove to about three leagues distance from the coast. Evening clear. Temperature of the air at 10 P. M. 66°.5, hygrometer 21°."

We should remark, in addition to this outline, that Mr JAMESON has added two tables at the end of his journal: one of these, we have already said, is meteorological, containing the state of the thermometer in the air at 10 morning and evening, and the temperature of the sea. This last, he observes in an accompanying letter to Professor JAMESON, was daily ascertained at 12 o'clock, in the usual way, by immersing a thermometer in a bucket of water fresh-drawn. In this table the humidity of the atmosphere is also noted, as observed at 10 morning and evening; "this was determined by two delicate centigrade thermometers, each degree of which is *divided decimally*; and the differences betwixt the dry and humid bulb exposed freely to the air, were daily registered." The state of the weather and the wind, as well as the latitudes and longitudes, are also inserted in this first table.

The second shews the daily differences and rates of three chronometers kept by Mr JAMESON himself on board the packet. In one column are the differences between BROWN'S and BARRAUD'S chronometers, in another between BROWN'S and GRANT'S, and in another between BARRAUD'S and GRANT'S: thus the relative rates of each could be ascertained without great difficulty. Mr JAMESON also gives here the mean temperature of each day, in case that should affect the instruments.

These tables we here insert.

Meteorological Journal from the Mouth of the Rio de la Plata, to the Coast of Peru.

Date.	Thermometer.				Leslie's Hygrometer.			Lat. S.	Long. W	Winds.
1822. Mar.	10 A. M.	10 P. M.	Daily range.	Sea.	10 A. M.	10 P. M.	Daily range.			
20	76°,5	73°,0	3°,5	74°,0	36°,0	35°,5	0°,5	35° 23′	51° 20′	NE.
21	72,0	68,5	3,5	74,0	28,0	17,0	11,0	35 38	52 32	SSE.
22	81,5	71,0	10,5	74,0	23,9	16,5	7,4	36 18	53 10	WNW.
23	69,0	68,5	0,5	75,0	20,0	17,5	2,5	36 38	53 20	Calm.
24	78,0	69,0	9,0	75,0	36,5	11,5	25,0	37 8	53 20	ENE.
25	70,0	67,5	2,5		17,0	8,0	9,0	38 42	53 57	W.
26	62,0	56,0	6,0		10,0	3,0	7,0	39 20	54 13	NW. very hazy.
27	61,0	58,0	3,0	52,0	15,5	8,5	7,0	41 10	56 17	
28	59,0	55,0	4,0	53,0	14,5	9,5	5,0	42 45	58 20	WNW. clear.
29	52,5	52,5	0,0	52,0	17,0	19,5	2,5	43 35	58 50	WNW. rain.
30	58,0	51.0	7,0	48,8	18,0	5,5	12,5	44 35	60 51	W.
31	54,5	51,0	3,5	49,0	20,5	4,5	16,0	45 21	59 18	NE. cloudy.
Ap. 1	48,7	48,0	0,7	49,0	5,5	5,5	0,0	46 20	61 52	SE. hazy.
2	54,0	54,0	0,0	50,2	5,5	8,5	3,0	47 21	62 25	S. hazy. NNW.
3	53,8	50,5	3,3	49,0	10,0	4,0	6,0	48 50	62 1	S. hazy.
4	55,5	50,0	5,5	48,0	9,0	6,0	3,0	49 57	61 26	NW. b W.
5	49,5	45,0	4,5	47,0	9,0	5,5	3,5	51 8	62 29	ESE.
6	49,7	47,0	2,7	47,0	20,0	8,5	11,5	52 25	64 29	NE.
7	47,0	45,0	2,0	45,5	8,5	5,5	3,0	54 46	63 26	S.
8	44,8	43,0	1,8	39,8	7,0	5,0	2,0	55 44	64 20	W.
9	41,5	40,0	1,5	39,5	7.5	11,0	3,5	56 45	65 45	SW. squally.
10	40,8	40,0	0,8	36,3	3,0	2,0	1,0	56 57	63 10	WSW.
11	43,0	41,0	2,0	37,0	2,0	2,5	0,5	56 59	64 13	WNW.
12	42,0	40,0	2,0	39,5	7,5	10,5	3,0	57 26	64 31	Calm. NW.
13	44,5	42,0	2,5	39,0	9,0	5,5	3,5	57 57	64 43	NW.
14	46,0	43,0	3,0	39,0	11,0	4,5	6,5	58 0	65 41	W. b N.
15	44,0	42,0	2,0	39,0	8,0	3,0	5,0	58 36	67 57	Calm. SE. squal.
16	33,0			41,0	5,5			57 40	71 21	SSE. S. SW.
17	32,0			41,0	4,5			56 24	72 46	S. b W. squally.
18	35,0				6,0			56 21	72 53	WSW.
19	38,0	35,0	3,0		7,0	5,5	1,5	56 28	73 55	N.
20	44,5	40,0	4,5	42,0	5,6	3,0	2,6	56 41	74 57	WNW.
21	39,0							57 2	75 45	West.
22	40,0				6,0			57 54	75 8	WNW.
23	33,0			41,0	4,0			58 52	76 21	WSW.
24	38,0	36,0	2,0	41,0	3,0		3,0	58 21	76 41	Calm. NE. b E.
25	36,0	33,5	2,5		10,0	4,0	6,0	58 0	77 43	W.
26	35,5	33,0	2,5		11,0	5,5	5,5	57 22	79 53	SE. b E.
27	40,5	37,0	3,5		19,0	10,0	9,0	56 19	81 30	W.
28	43,0	41,5	1,5		14,0	12,5	1,5	55 25	80 56	SSW. squally.
29	43,0	42,0	1,0		10,0	9,0	1.0	54 53	81 18	W. b S. squally.
30								54 13	81 23	SW.

Journal continued.

Date.	Thermometer.				Leslie's Hygrometer.			Lat. S.	Long. W.	Winds.
1822, May	10 A. M.	10 P. M.	Daily range.	Sea.	10 A. M.	10 P. M.	Daily range.			
1	43,0	42,5	1,5	44,7	7,5	6,0	1,5	53° 53′	80° 57′ ″	NW. calm, SE.
2	43,0	44,0	1,0	46,0	19,0	11,0	8,0	51 31	82 30	SE. fresh breeze.
3	46,0	48,0	2,0	48,4	9,5	3,5	6,0	49 15	83 32	SW. cloudy, rain.
4	51,0	52,0	1,0	50,0	6,0	8,5	2,5	46 56	83 55	NW. Ev. WSW.
5	52,0	50,5	1,5	53,0	12,0	4,0	8,0	44 11		S. cloudy.
6	53,0	54,0	1,0	56,0	7,0	16,5	9,5	41 27	83 12	SW. rain, S.clear.
7	56,0	56,0	0,0	59,0	14,0	16,5	2,5	39 43	83 23	SSE. S.
8	57,0	56,0	1,0	60,0	33,0	31,0	2,0	38 34	83 34	WNW.
9	58,0	60,0	2,0	61,0	34,0	33,5	0,5	37 1	83 17	West.
10	63,8	62,5	0,5	63,0	32,0	19,0	13,0	35 11	82 16 4	NW. b N. clear,
11	63,0	63,0	0,0	65,0	11,0	16,5	5,5	33 16		NW. cloudy.
12	63,0	63,0	0,0	65,0	16,0	15,0	1,0	32 4	78 54 4	E. clear.
13	63,0	61,5	1,5	64,5	19,0	17,0	2,0	30 42	78 18 12	E, clear.
14	64,0	61,8	2,2	65,5	29,5	15,0	14,5	29 32	77 18 00	E. clear sky.
15	63,0	61,0	2,0	63,7	28,5	28,0	0,5	28 22	76 4 45	ESE. variable.
16	65,8	64,0	1,8	63,7	32,0	27,5	4,5	27 53	75 35	SE. SW. cloudy.
17	64,5	64,0	0,5	64,0	23,5	22,0	1,5	26 53	74 27	ESE. clear.
18	64,0	64,0	0,0	65,6	20,5	16,5	4,0	24 47	73 36 4	ESE. str. breeze.
19	66,0	64,0	2,0	67,0	26,5	22,0	4,5	23 25	71 23 30	SE.
20		66,5		68,5		21,0		22 54	70 38 4	S. SE.

Table shewing the Daily Differences and Rates of three Chronometers kept on board the Fifeshire Packet, in the passage from Rio Janeiro to the Coast of Peru.

1822.	Brown's and Barraud's.	Difference.	R.	Brown's and Grant's.	Difference.	R.	Barraud's and Grant's.	Difference.	R.	Thermom. mean.
Mar.	° ′ ″	′ ″	″	° ′ ″	′ ″	″	° ′ ″	′ ″		
12	4 26 15			4 31 30			4 7 45			
	3 53 14	33 1	0	4 13 37	17 53	0	4 22 53	15 8	0	
13	8 43 6			8 47 30			8 25 0			
	8 19 52	33 14	13	8 29 28	18 2	9	8 40 12	15 12	4	
14	3 55 45			3 58 10			3 27 10			
	3 22 24	33 21	7	3 40 2	18 8	6	3 42 23	15 13	1	
15	3 55 10			3 56 45			3 26 50			
	3 21 39	33 31	10	3 38 30	18 15	7	3 42 6	15 16	3	
16	4 45 10			4 47 5			4 17 10			
	4 11 31	33 39	8	4 28 42	18 23	8	4 32 28	15 18	2	
17	5 4 30			5 6 35			4 35 35			
	4 30 40	33 50	11	4 48 7	18 28	5	4 50 58	15 23	5	
18	4 4 10			4 6 10			3 34 35			
	3 30 9	34 1	11	3 47 36	18 34	6	3 50 3	15 28	5	
19	4 38 25			4 40 5			4 9 10			
	4 4 12	34 13	12	4 21 21	18 44	10	4 24 39	15 29	1	
20	4 27 20			4 29 55			3 57 40			
	3 52 56	34 24	11	4 11 2	18 53	9	4 13 12	15 32	3	74.7
21	4 44 25			4 46 40			4 14 40			
	4 9 50	34 35	11	4 27 39	19 1	8	4 30 15	15 35	3	69.7
22	4 15 10			4 17 20			3 44 40			
	3 40 24	34 46	11	3 58 11	19 9	8	4 0 18	15 38	3	71.7
23	4 31 45			4 35 10			4 30 50			
	3 56 48	34 57	11	4 15 55	19 15	6	4 19 32	15 42	4	68.8
24	12 38 20			12 40 10			12 7 2			
	12 3 11	35 9	12	12 20 50	19 20	5	12 22 50	15 48	6	73.5
25	4 30 15			4 30 45			4 56 20			
	3 54 58	35 17	8	4 11 18	19 27	7	4 12 0	15 50	2	68.7

Table of Differences continued.

1822.	Brown's and Barraud's.	Difference.	R.	Brown's and Grant's.	Difference.	R.	Barraud's and Grant's.	Difference.	R.	Thermom. mean.
Mar.	° ′ ″	′ ″	″	° ′ ″	′ ″	″	° ′ ″	′ ″	″	
26	4 30 5			4 32 5			4 59 5			
	3 54 34	35 31	14	4 12 28	19 37	10	4 15 0	15 55	5	59 0
27	5 14 30			5 16 40			4 45 10			
	4 38 49	35 41	10	4 56 57	19 43	6	5 1 9	15 59	4	59.5
28	4 42 20			4 45 10			4 11 35			
	4 6 27	35 53	12	4 25 21	19 49	6	4 27 39	16 4	5	57.0
29	4 22 30			4 24 30			3 50 15			
	3 46 29	36 1	8	4 4 38	19 52	3	4 6 25	16 10	6	52.5
30	4 50 30			4 55 10			4 21 50			
	4 14 22	36 8	7	4 35 16	19 54	2	4 38 5	16 15	5	54.5
31	4 35 50			4 37 5			4 3 30			
	3 59 33	36 17	9	4 17 9	19 56	2	4 19 53	16 23	8	52.8
Ap. 1	4 39 40			4 42 15			4 8 55			
	4 3 15	36 25	8	4 22 16	19 59	3	4 25 22	16 27	4	48.3
2	4 20 20			4 22 10			4 47 10			
	3 43 43	36 37	12	4 2 5	20 5	6	4 3 42	16 32	5	54.0
3	5 3 45			5 6 5			4 30 50			
	4 27 0	36 45	8	4 45 55	20 10	5	4 47 26	16 36	4	52.2
4	4 53 10			4 57 30			4 21 30			
	4 16 15	36 55	10	4 37 14	20 16	6	4 38 10	16 40	4	52.7
5	4 41 50			4 43 0			4 7 30			
	4 4 45	37 5	10	4 22 40	20 20	4	4 24 16	16 46	6	47.3
6	4 53 10			4 55 30			4 20 10			
	4 15 57	37 13	8	4 35 6	20 24	4	4 36 59	16 49	3	48.3
7	5 3 15			5 4 15			4 29 10			
	4 25 55	37 20	7	4 43 47	20 28	4	4 46 3	16 53	4	46.0
8	4 14 00			4 15 30			3 39 40			
	3 36 29	37 31	11	3 55 0	20 30	2	3 56 41	17 1	8	43.9
9	5 15 25			4 18 10			4 42 20			
	4 37 45	37 40	9	4 57 35	29 35	5	4 59 26	17 6	5	40.8

Table of Differences continued.

1822.	Brown's and Barraud's.	Difference.	R.	Brown's and Grant's.	Difference.	R.	Barraud's and Grant's.	Difference.	R.	Therm. Mean.
April	° ′ ″	′ ″	″	° ′ ″	′ ″	″	° ′ ″	′ ″	″	
10	5 6 30			5 9 10			4 34 45			
	4 28 42	37 48	8	4 48 33	20 37	2	4 57 33	17 12	6	40.4
11	4 56 40			4 58 35			4 22 40			
	4 18 44	37 56	8	4 37 57	20 38	1	4 39 58	17 18	6	42.0
12	5 3 40			5 6 30			4 30 30			
	4 25 40	38 00	4	4 45 52	20 38	00	4 47 53	17 28	5	41.0
13	4 39 10			4 41 10			4 5 10			
	4 1 4	38 6	6	4 20 34	20 36	−2	4 22 41	17 31	8	43.3
14	5 24 40			5 26 30			4 50 20			
	4 46 29	30 11	5	5 5 56	20 34	2	5 7 58	17 38	7	44.5
15	5 4 50			5 6 40			4 30 10			
	4 26 32	38 18	7	4 46 6	20 34	00	4 47 55	17 45	7	43.0
16	5 14 10			5 16 30			4 40 10			
	4 35 43	38 27	9	5 55 52	20 38	+4	5 58 1	17 51	6	33.0
17	5 18 15			5 20 10			4 44 20			
	4 39 42	38 33	6	5 59 31	20 39	1	5 2 14	17 54	3	32.0
18	5 11 10			5 12 20			4 35 10			
	4 32 33	38 37	4	4 51 42	20 38	−1	4 53 9	17 59	5	35.0
19	5 7 50			5 8 40			4 30 50			
	4 29 8	38 42	5	4 48 2	20 38	00	4 48 53	18 3	4	36.5
20	5 36 10			5 38 40			5 1 20			
	4 57 23	38 47	5	5 18 2	20 38	00	5 19 28	18 6	5	42.3
21	5 2 10			5 3 30			4 26 50			
	4 33 19	38 51	4	4 42 52	20 38	00	4 44 24	18 14	6	39.0
22	5 8 10			5 9 45			4 32 40			
	4 29 12	38 58	7	4 49 7	20 38	00	4 51 00	18 20	6	40.0
23	5 36 30			5 37 45			5 1 10			
	4 57 23	39 7	9	5 17 3	20 42	+4	5 19 35	18 25	5	33.0
24	5 20 10		7	5 22 30			4 45 50			
	4 40 56	39 14		5 1 48	20 42	00	5 3 42	18 32	7	37.0

Table of Differences continued.

1822.	Brown's and Barrand's.	Difference.	R.	Brown's and Grant's.	Difference.	R	Barrand's and Grant's.	Difference.	R.	Thermom. Mean.
April	° ′ ″	′ ″	″	° ′ ″	′ ″	″	° ′ ″	′ ″	″	″
25	5 29 10 4 49 49	39 21	7	5 31 30 5 10 48	20 42	00	4 56 40 5 15 19	18 39	7	34.3
26	5 57 30 5 18 5	39 25	4	5 58 50 5 38 8	20 42	00	5 21 20 5 40 3	18 43	4	34.3
27	6 25 50 5 46 18	39 32	7	5 28 40 6 7 57	20 43	+1	5 51 10 6 9 58	18 48	5	38.8
28	5 27 15 4 47 37	39 38	6	5 28 10 5 7 27	20 43	00	4 50 10 5 9 6	18 56	8	42.2
29	5 22 10 4 42 26	39 44	6	5 21 10 5 3 27	20 43	00	4 48 00 5 7 00	19 00	4	42.5
30	4 44 15 4 4 21	39 54	10	4 44 50 4 24 3	20 47	+4	4 5 40 4 24 47	19 7	7	43.3
May 1	5 16 50 4 36 51	39 59	5	5 19 40 4 58 50	20 50	3	4 42 10 5 1 21	19 11	4	43.3
2	5 53 50 5 13 45	40 5	6	5 55 20 5 34 29	20 51	1	5 16 45 5 36 1	19 16	5	44.5
3	6 29 40 5 49 29	40 11	6	6 31 40 6 10 48	20 52	1	5 52 50 6 12 10	19 20	4	47.0
4	6 1 50 5 21 32	40 18	7	6 2 40 5 41 47	20 53	1	5 23 10 5 42 36	19 26	6	51.5
5	6 18 50 5 38 24	40 26	8	6 20 50 5 59 55	20 55	2	5 42 25 6 1 56	19 31	5	51.3
6	6 33 10 5 52 36	40 34	8	6 35 30 6 14 31	20 59	4	5 56 35 6 16 11	19 36	5	53.5
7	6 27 10 5 46 23	40 47	13	6 29 10 6 8 4	21 6	7	5 49 50 6 9 32	19 42	6	56.0
8	6 31 30 5 50 32	40 58	11	6 32 55 6 11 44	21 11	5	5 54 50 6 14 36	19 46	4	56.5
9	6 27 10 5 46 2	41 8	10	6 28 50 6 7 33	21 17	6	5 54 10 6 14 2	19 52	6	59.0

Table of Differences continued.

1822.	Brown's and Barrau's.	Difference.	R.	Brown's and Grant's.	Difference.	R.	Barrau's and Grant's.	Difference.	R.	Thermom. Mean.
May	° ′ ″	′ ″	″	° ′ ″				′ ″		
10	7 45 20			7 46 50			7 7 10			
	7 4 7	41 13	5	7 25 27	21 23	6	7 27 2	19 52	0	62.7
11	2 56 30			2 58 15			2 19 50			
	2 15 6	41 24	11	2 36 49	21 26	3	2 39 48	19 58	6	63.0
12	6 9 10			6 10 40			5 31 10			
	5 27 39	41 31	7	5 49 10	21 30	4	5 51 12	20 2	4	63.0
13	6 5 10			6 6 10			5 25 40			
	5 23 30	41 40	9	5 44 35	21 35	5	5 45 45	20 5	3	61.7
14	6 22 10			6 23 10			5 42 10			
	5 40 18	41 52	12	6 1 28	21 42	7	6 2 20	20 10	5	61.9
15	6 2 10			6 3 25			5 22 10			
	52 0 7	42 3	11	5 41 38	21 47	5	5 42 26	20 16	6	61.5
16	5 56 15			5 56 50			5 15 10			
	5 14 2	42 13	10	5 34 56	21 54	7	5 35 30	20 20	4	64.9
17	6 6 55			6 8 10			5 31 10			
	5 24 33	42 22	9	5 46 13	21 57	3	5 51 36	20 26	6	64.2
18	5 40 20			5 42 50			5 2 10			
	4 57 49	42 31	9	5 20 57	21 59	2	5 22 43	20 33	7	
19										
20	5 39 40			5 42 20			5 0 55			
	4 56 51	42 49		5 20 16	22 4		5 21 41	20 46		

Previous to Mr JAMESON's quitting Rio Janeiro, he had made one or two botanical excursions, the muscological fruits of which he transmitted to us. He writes, that they are specimens of all that he could collect at Rio de Janeiro. This he, however, adds, was probably owing to his being obliged to limit his walks within a few miles of the capital. It is a district hitherto little examined for the Cryptogamic department of Botany; and, therefore, as might have been anticipated, there are some new species in the packet.

We have to regret, that the imperfect state of some of them renders full descriptions impossible. We have, however, endeavoured to give such as we hope may serve in future to distinguish the plant.

LYCOPODINEÆ.

1. *Lycopodium rupestre*, LIN.

Var. Tenuior, caule ramisque subsimplicibus filiformibus; foliis lanceolato-subulatis, vix apice piliferis.

HAB. *Ad rupes intra portûs introitum Rio de Janeiro.*

Forte a L. rupestri species distincta, sed fructu non viso separare nequeo.

2. *Lycopodium convolutum*, NOB. Foliis bifariis imbricatis secundis ovatis acutis ciliato-dentatis, superficialibus minoribus geminis, caule erecto distiche, et alternatim ramoso, ramulis dichotome ramosis apicibus convolutis.

HAB. *In subalpinis aridis in Rio Janeiro.*

L. circinali proximum, sed ut supra differt. Fructus non observatus.

Musci.

3. *Gymnostomum Jamesoni*, HOB. Foliis late linearilanceolatis margine convolutis integerrimis, siccitate incurvotortuosis, nervo excurrente, theca turbinata ore amplo, operculo rostrato theca longiore.

HAB. *In collibus in Rio de Janeiro.*

Caulis quatuor ad octo, seta vix ultra duas lineas longa: annulus nullus. *G. tortilis* varietatibus majoribus satis refert, sed foliis, thecæ et operculi figura facile distinguitur.

4. *Dicranum bryoides*, HOOK.

HAB. *Rio de Janeiro.*

Plantæ Europææ omnino similis.

5. *Dicranum flexuosum*, HEDW. Caule subsimplici, foliis erectiusculis rigidis lanceolato-subulatis acuminatis, nervo latissimo, seta subflexuosa, theca ovata striata estrumosa calyptra basi ciliata.

HAB. var. β, *In collibus in Rio de Janeiro.*

Tres varietates hujusce speciei enumero:

α, Caule stricto, foliis lanceolato-subulatis rariter pilosis marginibus subincurvis, e basi vaginante, seta flexuosa. (*Campylopus flexuosus, C. pilifer*, et *C. penicellatus*, BRID. Meth., *Dicranum capillaceum*, BRID. Meth., *D. saxicola*, WEB. et MOHR.)

β, Foliis lanceolato-acuminatis pilo cano terminatis e basi vix vaginante, seta incurva.—*a*, caule strictiusculo, (*Dicr. introflexum*, HEDW.)—*b*, caule ascendenti-ramoso (*Polytrichum nigricans*, RICH. *Campylopus Richardi*, BRID. Meth. *Thesanomitrion Richardi*, SCHW. Suppl. tab. 118. haud bene.)

γ, Caule strictissimo simplici, foliis e basi late vaginante subulatis, seta incurva (*Dicr. filiforme*, BEAUV. et SCHW. Supp. t. 122. *Weissia volcanica*, BRID.)

Omnes hæ varietates setam juniorem plus minusve madore flexuosam; thecam effœtam plus minus striatam, ad basin tamen semper rugis acutis prominulisque scabram, calyptramque fimbriatam dimidiatam habent.

6. *Tortula cirrhata*, NOB. Foliis patentibus lineari lanceolatis margine undulatis, siccitate tortuosis, nervo valido excurrente, perichætialibus minoribus, theca cylindracea erectiuscula, operculo conico-rostrato. (*Trichostomum barbula*, SCHW. Supp. tab. 36. *Trich. barbuloides*, BRID. Sp. Musc. *Tortula lusitanica*, BRID. Sp. Musc.)

HAB. *In collibus in Rio de Janeiro.*

Peristomii dentes leniter torti, et ad basin membrana brevi connexi; operculum thecæ trientem longitudine æquat. Folia siccitate tortuosa, nitentia. Caulis 1 ad 9 lineas longa.

7. *Bryum argenteum*, LIN.

HAB. *Ad muros vetustos in Rio de Janeiro.*

8. *Bryum turbinatum*, SCHW.

Var. *minus*, HOOK. in HUMB.

9. *Bryum roseum*, SCHW.

HAB. *In subalpinis aridis in Rio de Janeiro.*

Mnium truncorum et *Domingense*, BRID., vix diversa suspicor, attamen non mihi visa fateor.

10. *Orthotrichum Jamesoni*, NOB. Caule repente, ramis erectis, ramosis, foliis ellipticis longitudinaliter plicatis, nervo breviter excurrente, seta longiuscula, theca ovato-oblonga lævi, calyptra campanulata lævi, basi integra appendicibusque latis aucta.

HAB. *Sylvis in Rio de Janeiro.*

O. rugifolio habitu proxime refert, differt tamen foliis non rugosis aliisque notis. Peristomium exterius e dentibus 8 rubris linearibus geminatis fissisve, siccitate revolven-

tibus constat: interius membranaceo-lacerum. Calyptra basi non fissa, sed laciniis latis aucta, hæque laciniæ statu juniore calyptram intus sursum duplicatæ sunt. Folia madore patenti-recurva, siccitate spiraliter quasi in funem torquata; perichætialia longiora. Theca junior inferne quadrisulcata, superne lævissima, brunnea*. Genus *Schlotheimia* vix stabilitum est: potius cum cæteris, Orthotrichi sectio secundo caule repente insignita constitui debet.

11. *Neckera undulata*, Hedw.

Hab. *In arborum truncis in Rio de Janeiro.*

Calyptra mihi mitriformis atque pilosa videtur: ciliæ etiam, non e membrana interna, sed e dentium lateribus progrediuntur; hæc species itaque ad *Daltoniam* Hookeri, vel *Cryphæam* Mohri pertinet.

12. *Hookeria tomentosa.*

Hab. *In sylvis in Rio de Janeiro.*

Hookeria vera est calyptra mitriformi: thecæ autem et operculi figura ab *Hookeriarum* omnium aliarum longe diversa. Hæc species eadem est ac *Hypnum tomentosum*, Hedw. Huic generi referenda est *H. tamarisci* vel *rotulata*, eadem enim est species.

13. *Hookeria albicans*, Hook.

Hab. *In sylvis circa Rio de Janeiro.*

14. *Hookeria affinis*, nob. Caule procumbente ramoso subcompresso, foliis undique imbricatis, oblongis acuminulatis, nervis duobus divergentibus ante apicem evanescentibus, emarginatis integerrimis, theca recta horizontali, oper-

* Duæ alteræ species *O. rugifolium* et *Swainsoni*, "prope Rio Janeiro." crescentes jamdudum ab ill. Hookero descriptæ sunt.

culo conico rostrato, seta lævi, calyptra glabra basi multifida.

Hab. *In sylvis circa Rio de Janeiro.*

Hæc species plerasque *Hookerias* simulat; a *H. depressa* operculo longiore, calyptra basi multifida, et, an sit bona Hedwigii tabula, cellularum magnitudine, differt: a *H. scabriseta* seta lævi; et a *H. pendula* calyptra lævi.

15. *Hookeria prælonga*, nob. Caule reptante pinnatim ramoso, ramis simplicibus laxe foliosis, foliis distichis subrotundis acuminatis integerrimis, enervibus.

Caulis longus repens; foliorum textura laxa ut in Hookeriis, sed fructus non visa.

16. *Hypnum loxense*, Hook.

Hab. *Rio de Janeiro.*

Ad specimina Humboldtiana exacte congruens, quanquam ex " sylvis Cinchonæ, regione temperata, juxta Loxam et Gonzonanam, alt. 1080 hexap." allata.

17. *Hypnum imbricatum*, Schw.

Hab. *In sylvis umbrosis in Rio de Janeiro, ad arborum truncos ramulosque, et ad rupes.*

Fructus non adest. Forte ab hac specie non differt *H. hexastichum*, Schw.

18. *Hypnum minutulum*, Hedw.

19. *Hypnum subsecundum*, nob. Caule repente subpinnato brevi inferne nudiusculo, foliis sursum patentibus, ovatis acuminulatis concavis, margine recurvis, integerrimis, enervibus, theca erecta ovata, operculo hemisphærico-rostrato.

Hab. *In sylvis in Rio de Janeiro.*

H. crassiusculo habitu et magnitudine proximum; dif-

fert foliis late ovatis, valde concavis, operculo non subulato, theca erecta æquali. Folia sursum solummodo spectant, certe autem non ad tribum foliis falcatis seu secundis designitam pertinet, omnes enim hæ species folia deorsum spectantia habent. Thecam vix maturam possideo, sed de genere non dubito; peristomii dentes externi sordide lutei, interni lutescentes. Folia ratione plantæ magna, reticuli areolis ut in plurimis *Pterogonii* speciebus. Forte mera varietas *H. crassiusculi* in quo etiam foliorum margines subrecurvas video.

20. *Hypnum amœnum*, Hedw.

Hab. *Ad arborum truncos in Rio de Janeiro.*

Ab hac specie non differt *H. recurvans* ex America boreali, nec video quomodo distinguitur a *H. cupressiformi* variabili thecæ forma insigni.

21. *Fontinalis squamosa*, Lin. var.

Hab. *Rio de Janeiro.*

Vix duabus unciis longior: fortasse in locis aqua in æstate deficiente crescit, itaque robusta. Folia crassa canaliculata margine versus apicem involuta.

Hepaticæ.

22. *Jungermannia patula.*

Hab. *In sylvis in Rio de Janeiro.*

Folia solummodo apice dentata: igiturque ab hac specie removeri debet *Carpolepidum dichotomum*, Beauv.; habet enim folia non solum apice dentata, sed tota margine ciliato-serrata, secundum exemplaria in herbario Belvisiano conservata: ad *J. adianthoidem* itaque allocanda; sed, ut bene dixit Weberus, "num *J. patula* satis a *J. adianthoide*, foliis vix, nisi apice, dentatis differat, peritioribus est dju-

dicandum." Habitus eadem, et nisi discrimina levia supra notata, nihil plane interest.

23. *Jungermannia bracchiata?* Sw.

Hab. *In collibus prope Lima*, unde inter muscos ex Rio de Janeiro misit Jamesonus.

J. filiformi valde similis: differt tamen foliis apice rariter denticulatis, stipulisque foliis multo minoribus. *J. brachiatam* vix cognosco; exemplaria Swartziana dicta ab amicis recepta descriptionem Swartzianam certe non quadrant, folia enim obtusa integerrima, et stipula oblonga videntur.

24. *Jungermannia Tamarisci?* Hook. Caule procumbente ramoso, foliis inæqualiter lobatis, lobis superioribus ovatis concavis integerrimis; inferioribus linearibus vel clavatis integerrimis, stipulis subrotundis apice ætate bifidis.

Hab. *Ad arborum truncos in Rio de Janeiro.*

Caules stricti, ramosi ramulis subcurvatis: folia arefactione retro circa caulem convoluta. Sub nomine *Hypni?* recepi, sed potius *Anictangium ciliatum* var. *filiforme* primo intuitu refert.

Fructus non visus.

25. *Jungermannia platyphylla*, Lin. Var. tenuior.

26. *Jungermannia multifida*, Lin.

Hab. *Rio de Janeiro.*

Huc certe allocari debent *J. palmata* et *bipinnata*. Sw.

XI.—*Inquiry into the Origin and Characteristic Differences of the Native Races inhabiting the Extra-tropical Part of Southern Africa.*

By Robert Knox, M. D.

Member of the Wernerian Natural History Society, and of the Medico-Chirurgical Society of Edinburgh.

(*Read* 19*th April* 1823.)

THE best apology I can offer for attempting the Inquiry I have now the honour to lay before the Society, is, that no similar one, relative to the country I speak of, has ever been instituted. Many travellers have described, with a minuteness proportioned to their talent for observation, the Peninsula of Southern Africa, and have given to the world valuable works on its natural history, political relations, &c.; but, so far as I know, none has ever viewed the savage races inhabiting this Peninsula in an anatomical point of view, and hence have arisen ill-founded conjectures, and positive errors, too numerous to be criticised. I have endeavoured to correct those more immediately connected with our inquiry, but have carefully avoided general criticism, as leading me from the subject. The Society will

readily imagine the difficulties I experienced in avoiding frequent conjecture, and the impossibility of doing so altogether; but recourse has been had to conjecture rarely, and, though some of the conclusions may, from insufficient data, or other causes, prove erroneous, I shall still feel sufficiently recompensed for my labour, should the facts I have collected be found serviceable to those engaged in writing the Natural History of Man.

The part of Africa situated to the south of the Tropic, contains at least three distinct races of men. Those met with in proceeding from Cape Point northerly, are intruders; they constitute the Anglo-Dutch colony of the Cape, and are a mixture of almost all the modern nations of Europe, the Dutch preponderating. The colonists dwelling in the remoter districts attain a gigantic size, owing, no doubt, to their descent from a race naturally tall; and in perfecting which, as to stature, much has been effected by climate, food, and other localities. This race, at present, extends from Cape Point northward to the banks of the Gariep, or Orange River, and eastward as far as the Keiskamma River. They have pushed before them, and partly exterminated, the race of Hottentots, or Bosjeman (for I shall consider them as the same), who are now found only in small numbers, either as servants to the colonists, or still preserving a sort of savage independence in that vast tract of almost desert country, extending from the chain of mountains out of which the Gariep and Great Kei rivers rise, westward to the shores of the Southern Atlantic. On the verge of the Tropic, and close to the western shore, the Damaras are found (a Negro race, as I have been assured), who extend towards Benguela and Congo; so that the Bosjeman race, if they exist much to the north of the Gariep River, must occupy a central stripe of Africa,

bounded, on one hand, by the Damara and Benguela countries, and, on the other, by the Kaffer nations.

These latter extend from the Keiskamma eastward along the coast towards Inhambane; but previous to reaching this point, they become inland, and possess the mountain-country, which, there is every reason to suppose, may extend from the sources of the Gariep and Great Kei rivers, to the Equator. It would appear from the Journal of VAN REENEN, that the Temboo is the last of the Kaffre tribes found on the coast of Natal, and that beyond them, in about Lat. 26° S., are found the Hamboonas, a race totally different from the Kaffres. They are thus described: "Ce peuple a la peau jaunatre avec de longs cheveux fort epais et frisés, qui sont relevés sur le sommet de la tête en forme de turban *." At the point of coast where the Hamboonas disappear, the Negro race commences, and, extending around Sofala, Inhambane, and Mozambique, furnish the Portuguese with the most ample means of carrying on a traffic the most revolting to the feelings of mankind. The mountain-country, inhabited by the Kaffre race, cannot be of any great breadth, limited as it is on the east by the Negro country of Mozambique, and to the west by the vast and unknown deserts supposed to be inhabited by the wandering Macasses. It is unfortunate for our present inquiry, that two geographical problems of much interest remain to be solved. The Kaffre races have been conjectured to be Arabian, and the Bosjeman tribes have been considered by some of Chinese origin, by others

* I consider the Hamboonas (if they really exist) as descended from a race of shipwrecked Chinese or Malay mariners, modified by intermarriage with Negro or Kaffre tribes. It is, however, quite possible that they may be a race from Madagascar.

of Egyptian; they have even been compared to the Troglodytes or Pygmies of HERODOTUS, that dwelt in the deserts to the south of Barca and Syrene. We shall presently see that the Kaffres are not Bedouin Arabs, and, moreover, that they cannot be traced to any European or Caucasian stock; but the question of origin, as regarding the Bosjeman, is of far more difficult solution. It were highly desirable, as well for geographical science as for the natural history of Man, that the extent of country occupied by the Kaffre race, from the Keiskamma northwards and eastwards,—in other words, the boundaries of Kaffraria Proper,—were correctly ascertained. We know that the race extends on either side the mountain-country stretching from the sources of the Gariep towards the Equator, inhabiting the valleys and slopes of the mountains: their progress westward was probably arrested by the existence of great central deserts, and by their natural dislike to such countries; whilst eastward, that is, towards the Indian Ocean, numerous Negro tribes were in possession of the country. That they have long been an inland race, is evident from their total ignorance of the use of boats or canoes: moreover, the Portuguese, in their ardent search after gold, received some severe checks from the black races inhabiting the mountains to the westward of their settlements: now, it is probable that these were Kaffre tribes, for Negroes are naturally timid, and easily subdued.

It is much more difficult to guess with any shew of probability at the extent of the Bosjeman nations, partly from their total dissimilarity to all surrounding tribes, and partly from the extremely defective state of our knowledge relative to the geography of Central Africa. It is well known that they originally extended to Cape Point, and have been found to the northward as far as Europeans have yet penetrated. Beyond this all is profound obscurity: How, then,

are the aborigines of Southern Africa to be traced to the primitive races of the ancient world? In the absence of all historical detail relative to the affiliation of these races, and until some future Park shall make us acquainted with Central Africa, as well to the south as to the north of the Line, both being equally unknown, we shall bring together the results presented by anatomical inquiry, which, being a method founded on fixed and general physical laws, will, if it attain not the truth, at least approximate to it.

We may view the human race as derived originally from one stock, to which the arbitrary name of Caucasian has been given. This species, influenced by climate and civilization, assumed, at a very early period, five distinct forms, which have also been arbitrarily designated by the names of Caucasian, Mongolic, Ethiopian, American, and Malay *. We cannot hesitate referring the Kaffre nations to the Ethiopian, not so much from their position, as from their close resemblance; whilst the Bosjeman may be arranged, for the present, with the Mongolic, until further investigation shall have shewn a more intimate relation with some unknown African tribes, or until the race shall have been fairly traced through Central Africa to the Valley of the

* I shall here take the liberty of remarking, that the Malay race seems to me an artificial variety, and has no existence in nature as a distinct race of men. I am inclined to refer the whole inhabitants of the innumerable islands scattered over the Great South Sea (including New Holland) to the American variety. In Southern India they have mixed with the Mongolic and Caucasian races, and form consequently a mixed or mulatto breed; but they may be traced tolerably pure as high as Sumatra, in which island several tribes are found much resembling the native Americans, and retaining all their customs, even to the pretended flattening of the head by artificial means. It is probable that in this race only are found the anthropophagous tribes.

Female figure sculptured in the cave of Elephantina in India supposed by D'. Anearville to have been formed about 2110 years prior to the present era

Nile, and thence to Asia, where we suppose all nations to have originated.

Var. ETHIOP.

NEGRO.	KAFFRE, including Temboo, Briquas, Boshuanas, Red Kaffres, &c. &c.
Colour generally very dark.	Of a brown colour; some perfectly black.
Hair black, and, as it is called, woolly.	Hair uniformly black, crisp, and woolly, and scattered in small tufts over the scalp.
Head narrow, compressed on the sides.	Cranium narrow, elongated, resembling in outline the female European *.
Forehead arched.	Forehead differing but little from the Negro, that is, rather retreating; very narrow, and not high.
Malar bones prominent; eyes full.	As in the Negro.
Nose thick, and little distinct from the lips.	In the greater number nearly as in the Negro; some have less of the Ethiopian physiognomy.
Upper jaws elongated forwards.	The osseous development of the upper jaw nearly as great as in the Negro.
The superior incisors obliquely projecting.	Hardly the case in the Kaffre.
Excessive fulness of the lips.	Nearly as in the Negro.
Retreating chin.	Not so much so as in the Negro.
Many bandy-legged. A certain difficulty in maintaining the upright position; the knees slightly bent, and the heels constantly tending to quit the ground. The gastrocnemii muscles placed too near the ham.	Never the case in the Kaffre. His lower extremities are finely proportioned, and frequently of Herculean strength; the upper extremities weak and disproportioned; whilst the lower limbs, pelvis, and loins, are superior even to the European.

* Compare the accompanying sketch of the Kaffre cranium (Plate VII.) drawn from one in my possession, with a cranium of the Caucasian variety.

The cranium of the Kaffre is inferior in most of its measurements to the European. The temporal bones are flat and compressed, and the squamous suture often straight, instead of being semicircular, as in the European *. They are nice in the choice of their food, and reject fish, fowls, and generally whatever by the Levitical law is deemed unclean; yet they eat the inner parts of animals, as the intestines, stomach, lungs, &c. raw, torn from the animal just dead.

From a careful consideration of the habits and configuration of this race, I believe them to be closely allied to the Negro, and that the observable differences are attributable to the different climates they inhabit. The Kaffres, in a word, are the Negroes of the mountains; they are Negroes changed by inhabiting an extra-tropical climate; like all mountaineers, they are hardy, bold, and fond of liberty. In intellect they are superior to the Negro, and I believe them capable of a very considerable degree of civilization. The remarkable disproportion observable between the upper and lower extremities of the Kaffre † may, perhaps, be owing to the very unequal degree of exertion to which these separate parts of the body are exposed. The Kaffre never labours, and hence his arms are weak; but he is strongly exercised in the chase and in predatory excursions, by which means his limbs become muscular, and occasion-

* Some Kaffre skulls have been shewn me, in which the malar bones were remarkably large, and the face very broad; but this is not the usual Kaffre physiognomy. Such anomalies exist amongst all nations and races, but cannot be supposed sufficient to refute the general position, that each race has a form of cranium and face peculiar to itself.

† Of twenty-two ivory armlets, taken indiscriminately from the arms of Kaffres, four only were found which could admit the arm of a moderately muscular European.

ally altogether Herculean. The excess of nutrition gives rise, no doubt, to the enormously swelled legs to which many of them are liable, when, through indolence, or the infirmities of age, they are disinclined to continue the same life of activity. Circumcision and polygamy they practise with almost all African nations.

According to the relations of modern and ancient travellers, tribes similar to the Kaffre race are found scattered over Africa, apparently unconnected with each other. We are told of a nation of Negroes, called Nubœ, inhabiting the country to the west of the Nile, near the confluence of the Abyssinian and true Nile: they are described as being mild in character, and of small features, though the nose be flat, and the hair woolly: they speak a soft sonorous language, differing in these points from their neighbours. Travellers describe the Ababdes, living to the east of the Nile, as being Blacks, with European features. But as few travellers have been anatomists, their accounts cannot altogether be depended on.

A very general belief prevails, that, by external means, and more particularly by pressure, the human cranium and form generally may be modified, and permanently altered, and that this may at last become hereditary. It is asserted, for example, that the more remarkable craniological differences amongst nations are occasioned by external pressure; that the flatness of the African nose arises from the same cause; that Negroes are bandy-legged, because they are carried during infancy on their nurses' back; and that the large feet of the Kaffre, and the small ones of the Bosjeman, are owing to an abundant supply of food to the former, and a deficient one to the latter *. All such asser-

* Blumenbach de Nat. Variet.

tions are constantly refuted by an appeal to facts. The feet and hands of the Kaffre and Bosjeman are strictly and beautifully proportional: though they be carried during infancy in the same manner as the Negro, they are never bandy-legged or deformed. The African nose is flat, independent of any mechanical skill exercised by the nurse; and human crania are fashioned all over the world by the hands of Nature, and not by man.

Var. MONGOL.

True MONGOL inhabiting the deserts of Central Asia.	AFRICAN BOSJEMAN, including the numerous Hottentot tribes, as Namaquas, &c. &c.
Colour yellow, or of an olive tinge.	Colour light yellow, or olive; it is difficult to describe, and varies in intensity amongst the Hottentots; but is pretty uniform amongst the true Bosjeman.
Hair black, coarse, straight, and scarce.	Hair black, usually short, though sometimes growing to a considerable length, and is scattered over the scalp in detached tufts, as in the Kaffre.
Head of a square form.	General outline of the head much resembles the Mongol, that is, broad and square.
Face broad, flat, depressed, the features being therefore, as it were, confluent.	Face having a considerable resemblance to the true Mongol; the lips are full.
Forehead smooth and flat.	As in the Mongol.
Nose small and flat.	
Aperture of the eye-lids narrow and linear.	As in the Mongol. The angle at the internal canthus of the eye is quite rounded away.
Chin somewhat projecting.	Chin very small and pointed, but not projecting.

In addition to these characters of the races, I may remark, that in the Bosjeman there is the finest symmetry of the whole frame: their stature is remarkably diminutive; I should conjecture the average to be about 4 feet 6 inches in the male population. The females have remarkably prominent nates and elongated nymphæ; both these peculiarities are removed by a single cross with the Kaffre or European. The Bosjeman have uncommon powers of vision; this also is lost by intermarriage with another race. The cranium is finely formed, and thin; the nasal processes of the superior maxillary bones large and broad: these give to the Mongol and Bosjeman the appearance of breadth at the root of the nose. The foramina for the transmission of the hypoglossal nerves, are very large*. The cranium, viewed vertically, is nearly equal to the well-formed European head. The parietal bones bulge out very much, and the cranium is at this point broadest. It agrees with the Mongol in having the occipital foramen larger than in the other races. The floor of the orbit does not encroach so much on the cavity as in the Mongol; this affects the physiognomy to a considerable extent, in so far as regards the direction of the eyes.

The habits of the Bosjeman race have been described by most African travellers with sufficient accuracy, and I shall therefore limit my remarks to a few points of resemblance between the true Mongol and Bosjeman races. This consists, first, in the countries they inhabit, which, in either case, are vast elevated sandy deserts, nearly destitute of herbage and water: secondly, in the partiality both races

* These foramina are decidedly larger in the Black than in the White races, but more particularly in the Negro. They clearly indicate the passage of a proportionally large nerve.

have for horse-flesh as an article of diet, preferring it to every other sort of food; they strictly merit the appellation of *Hippophagi:* lastly, in the acuteness of their vision, which almost exceeds belief. I have found their sight to be equal to that of most Europeans when aided by excellent hand-telescopes of the best construction. The Bosjeman is ingenious, clever, and neat-handed; his powers of mimickry are great, his understanding good. He readily acquires languages, and his speed of foot is almost proverbial.

The origin of the race, by which I mean the mode of their descent, and separation from one or other of the more extended varieties of the human race, is one of the most interesting inquiries which the natural history of Man presents. To connect the Bosjeman with the Mongolin variety, we must step at once from the Peninsula of Southern Africa, to the great central deserts of Asia; the intermediate links are lost,—the intervening races unknown. History, though not altogether to be depended on in the consideration of events so remote, must not in the present instance be despised. Though surcharged and disfigured with fable, there is one fact to which such constant allusion is made, as almost to put it beyond a doubt,—I allude to the frequent descents of the northern Asiatic races on the southern states of Europe and Asia. The valuable monuments of antiquity, still preserved in the Cave of Elephantina, in Peninsular India, attest the predominating presence of the Mongol race, at a period removed from the birth of our Saviour by more than 2000 years *, and that, at that time;

* Compare the annexed drawing (Plate VII.) of the female figure sculptured in the Cave of Elephantina, and copied from the "Recherches sur l'Origine des Arts," with the beautiful and expressive portraits of the Bosjeman and Hottentot races by Mr Daniells in his "African Scenery."

the Mongol physiognomy bore the strongest resemblance to the present Chinese and Bosjeman races. The early introduction of the Mongol or Northern Asiatic races into Peninsular India is further attested by their influence on the modern Hindoo; for though the excellent BLUMENBACH assures us that the Hindoo cranium is quite equal in beauty and proportions to that of the Turk, and consequently refers the race to the Caucasian variety, yet, in the Hindoo heads I have examined, the development of the upper jaw has not been strictly Caucasian *.

The vast antiquity of the Mongol hordes of Asia is further proved by the early establishment of the Chinese empire; and though I am fully persuaded of the still greater antiquity of those of Hindostan and of Egypt, yet many passages in HERODOTUS point out that the Mongolic tribes, with a rapidity even exceeding the Caucasian, rapidly assumed the form of great and warlike nations.

It would seem, then, from a hasty examination of historic records, of the remains of antiquity, and of the laws and religious ceremonies transmitted from generation to generation, that at a very early period the Mongol races penetrated into Europe † and southern Asia; and there is nothing improbable in the supposition, that they may have

* The inspection of a fine collection of skulls, collected on the Banks of the Ganges, and which, through the kindness of Professor JAMESON, I was enabled to examine immediately on their arrival, has confirmed me in this opinion. In these skulls, which, with the exception of one Negro head, seem all to be of the Caucasian race, the cranium is quite equal to any European, and its longitudinal diameter shorter than in most: but there is a development and strength in the upper maxillary bone which, I should think, will not be found to exist in any Turkish, Syriac, or Jewish head.

† The peculiar Mongol face is very strongly marked in many families now inhabiting the Highlands of Scotland, and more particularly the Hebrides.

modified by their presence some of the races of central Africa.

Lest it might seem an omission that I have not described the Mongol race as having penetrated into the wilds of America, I shall here state, that the few Esquimaux crania examined by me, have proved to be strictly American, nor have I ever seen the slightest approach to the Mongol head in any native American race. I have only further to observe, that most of the opinions offered in this memoir are founded not on theory or conjecture, but on an anatomical examination of the crania of numerous races of men. For the opportunity of doing so, I am in a great measure indebted to Professor JAMESON, and to Doctors MONRO and BARCLAY, through whose politeness I was allowed to examine whatever specimens their valuable museums contained. I beg leave to offer my thanks to these gentlemen.

The annexed table gives a comparative view of the measurements of the head in several remarkable varieties of the human race.

EDINBURGH,
March 1. 1822.

	Hottentot.	Cranium supposed to be from New Holland.	New Hollander.	Cranium supposed to be Malaic.	European Female.	Hottentot Venus, (from a cast).	Male Kaffre.	Male European.	Negress.	Turk.	Carib.
Length of the face from the root of the nose to the edge of the alveolar process,	Inches. 2.3	Inches. 3	Inches. 2.5	Inches. 3	Inches. 2.8	Inches. 2.7	Inches. 2.8	Inches. 2.9	Inches. 2.6	Inches.	Inches.
From the anterior portion of the foramen occipitale to the incisive teeth of the upper jaw,	3.7	3.7	4	3.7	3.7		4.1	3.3	4	3.5	3.5
Breadth at the temples*,	3.6	3.8	3.8	4.1		3.5				3.5	3.4
Whole circumference,	19.7			20.1	19.7	19.8	21	20.7	19.6	19.6	18.8
Greatest breadth †,	5.2	5.4	5.7	5.8		5.3			5.1	5.1	5.4
Foramen occipitale ‡,	1.3 by 1 5	1.5 by 1.1		1.3 by 1.5					1.3 by 1.1		
Length over the vertex, that is, from the ossa nasi to the posterior edge of the occipital foramen,	14.1	21.1	21	14.5	14.3	13.5	14.6	14.9	14.9		
Measurement from mastoid to mastoid over the vertex,	13	21	21	15.6	14	12.7	14.2	14.7	14.5		

* Not to be depended on.

† Varies very much; broadest, however, generally over or near the temporal bones; sometimes, as in most of the black races, in the middle of the parietal bones.

‡ Generally speaking, the foramen occipitale is largest in the Mongul, and smallest in the Negro. I have seen it very large in the Esquimaux, but am not sure that this is constant.

XII.—*A Monograph of the Genus* Pyrola.

By Mr David Don, Librarian of the Linnean Society, M. W. S.

(*Read 21st April* 1821.)

WHEN we contemplate the great increase of new species which Botany is daily acquiring, Monographs are rendered indispensably necessary to the exact knowledge of the species which compose particular genera, and more especially of such whose species are nearly related to each other. The genus *Pyrola*, although far from being numerous in species, has nevertheless been hitherto involved in much confusion. I have corrected the synonymes, and endeavoured to improve the specific characters of the older species; but, considering the great difficulty which attends such a task, I fear, in the latter point, I have not in many instances been successful. For the new or rare species contained in the following pages, I am indebted to the kindness of Mr Lambert, and Mr Brown. The last distinguished botanist, who is now in possession of the Banksian Herbarium, has with great liberality permitted me to ex-

amine the several new species contained in that splendid collection.

The genus *Pyrola* belongs to the natural order *Ericeæ*, as now constituted, comprizing the *Ericæ* and *Rhododendra* of JUSSIEU, and to the section of true *Ericeæ*, from which it would be unnatural to exclude the *Vaccineæ* of M. DE CANDOLLE. The *Monotropeæ*, another section of *Ericeæ*, first proposed by Mr NUTTALL, in his Genera of North American Plants, consist of *Monotropa* and *Hypopithys* (which ought to be again united to *Monotropa*, being not sufficiently distinct from it), and his new genus *Pterospora*. These in many respects approach near to *Pyrola*, both in habit and characters, and especially as there is a leafless species of *Pyrola*; but the manner of emitting their pollen is totally different, not being by pores, but by lateral fissures. The anthers of *Monotropa* are not, as Mr NUTTALL has supposed, unilocular, although, after shedding their pollen, and from the peculiar mode of emitting it, they appear to be so: they are flat and circular, furnished with two very short obtuse horns at their base, and emit their pollen by two transverse fissures on their internal surface. Those of *Pterospora*, on the contrary, shed their pollen by longitudinal fissures, and have two very long subulate horns at their base. This plant appears to be the link between these two sections.

The whole genus being perfectly natural, I have preferred retaining it entire. I have separated the whole into two divisions, and these I have again subdivided into sections. The first division contains the largest portion of the species, consisting of those the valves of whose capsules begin first to open at the base, with their margins connected with an intricate fine tomentum, with alternate leaves, and

flowers disposed in racemes. The second division consists of such as have the valves of their capsule beginning to open first at the top, and their margins unconnected by any kind of tomentum; with verticillate leaves; flowers solitary, or corymbose. This division contains only four species, subdivided into two sections. To the first section belongs *P. uniflora*; and to the second belong *P. umbellata*, *maculata*, and a new species *P. Menziesii*. These three last constitute the genus *Chimaphila* of Pursh, the *Chimaza* of Mr Brown. I have, however, preferred considering them as a section rather than a distinct genus. They differ chiefly from the other species by their stipitate filaments, by the valves of their capsule opening first at the top, with their margins destitute of the connecting tomentum, and the lobes of the receptacle being bipartite: these two last characters they have in common with *P. uniflora*. The style, which, in *P. umbellata*, is immersed in the germen, is very short in *maculata*, so as to be just distinguished from it; but, in *P. Menziesii*, which is very nearly related to the last, it is perfectly distinct from the germen. Their general habit has been much insisted on as a just reason for their separation; but this difference in habit is not near so striking in them as in *P. uniflora* and *aphylla*, and yet the flowers of the latter are so like those of the *rotundifolia*, that unless for a slight difference in the laciniæ of the calyx, they might readily be confounded.

The species of this genus are extensively diffused through the northern Hemisphere. In the Temperate Zones they are chiefly met with in mountainous situations, some of the species, such as *P. uniflora* and *secunda*, extending to considerable elevations: in the Frigid Zones, on the contrary, they are only to be found in the lowest and narrowest plains adjacent to the sea, and are never met with in these regions

beyond the limit of trees. Most of the species extend across the Continents of Asia, Europe, and America. There are specimens of *secunda* and *uniflora* in the Banksian Herbarium, from the islands on the north-west coast of America. The *P. picta* of SMITH is found on the north-west coast of America, and in mountainous situations in Japan. Some species, however, are of more limited diffusion: thus, *P. asarifolia*, *maculata*, and *elliptica*, have only been found in North America. The *P. dentata*, *Menziesii*, and *occidentalis*, are still more confined, being only found in particular districts.

Their favourite places of growth are woods, especially old pine and birch forests, and bushy places, and mountainous heaths, in a dry light soil, particularly that formed from decayed vegetables, mixed with a great proportion of siliceous earth.

All the Pyrolæ are possessed of a strong astringent quality, and were formerly much esteemed for supposed healing properties: they are now wholly disused. The *P. maculata*, however, is deserving of the attention of physicians, and is held in great esteem among the Indians of North America, who call it, according to Mr PURSH, *Sip-tisewa*. This botanist tells us, that he has witnessed the beneficial effects of a decoction of this plant, in a very severe case of hysterics; and I am credibly informed its decoction has proved very serviceable in scrofulous diseases.

PYROLA, *Tourneſ. Linn. Juss.*

CHIMAPHILA, *Pursh*; CHIMAZA, *Brown.*

Linn. Syst. DECANDRIA MONOGYNIA.

Nat. Ord. ERICEÆ. § 1. *Ericeæ veræ.*

CHAR. ESSENT. *Calyx* 5-partitus. *Petala* 5. *Antheræ* basi foraminibus 2 hiantes. *Stigma* 5-lobum. *Capsula* 5-locularis. *Placentæ* lunatæ. *Semina* angustè scobiformia, utrinque alata. *Embryo* transversus.

Character prolatus Generis.

Calyx parvus, 5-partitus, persistens. *Petala* 5, hypogyna, imbricatim conniventia, caduca. *Stamina* 10: *filamenta* subulata, hypogyna, rarò (in *Chimaphilâ*) stipitata: *antheræ* 2-loculares, foraminibus 2, sæpiùs tubulatis, ad basin hiantes, postmodò inversæ. *Pistillum* 1: *ovarium* globosum: *stylus* simplex, sæpiùs elongatus, nunc rarò vix ullus: *stigma* 5-lobum. *Capsula* globosa, 5-locularis, 5-valvis, medio loculorum singulorum 5-fariam dehiscens: *valvis* margine tomento tenuissimo sæpiùs intricatè connexis. *Placentæ* 5, lunatæ, spongiosæ, simplices v. bipartitæ, axi centrali 5-angulo insertæ. *Dissepimenta* axis centralis angulis adnata. *Semina* numerosissima, minuta, angustè scobiformia, basi apiceque alata, funiculo umbilicali per medium placentis adnata: *testa* simplex, reticulata, membranacea, laxa, fuscescens: *albumen* carnosum, subrotundum, album. *Embryo* transversus, minutus, niveus, in albuminis extremitate umbilicali: *cotyledones* breves, crassæ, obtusæ: *radicula* brevissima, crassa, obtusa, umbilicum spectante.

Hab. veget. — Herbæ *vel* suffrutices, *sempervirentes, humiles, radicibus latè repentibus.* Folia *petiolata, alterna,*

terna, vel rariùs verticillata, glabra, sæpiùs nitida, coriacea, crenulata, dentata aut serrata. Scapi *erecti, squamis paucis sparsis instructi, sæpiùs triquetri vel 4-anguli, convoluti.* Flores *pedicellati, bracteati, penduli, globosi vel campanulati, s. rarò patuli, albi aut rosei, in racemis sive corymbis terminalibus dispositi, rarò* (*in* P. uniflorâ) *solitarii.*

CONSPECTUS SPECIERUM.

DIVISIO I.—*Capsulæ valvarum marginibus, tomento tenuissimo intricatè connexis, à basi dehiscentibus. Foliis alternis. Floribus racemosis.*

SECT. 1.—*Stamina* adscendentia. *Stylus* declinatus, petalis longior. *Stigma* annulatum.

Scapi *erecti.* Flores *campanulati, racemosi, penduli, undiquè versi, v. rariùs subsecundi.*

1. *P. rotundifolia,* foliis subrotundis integerrimis crenulatisve coriaceis petiolo dilatato brevioribus, scapo triquetro, laciniis calycinis lanceolatis acutis, stigmate clavato obtusè 5-dentato.

2. *P. asarifolia,* foliis reniformibus coriaceis repando-crenatis petiolo dilatato duplò brevioribus, scapo acutè triquetro, racemo multifloro, laciniis calycinis ovatis acuminatis appressis, stigmate clavato: disco elongato 5-dentato.

3. *P. chlorantha,* foliis orbiculatis retusis obsoletè crenulatis petiolo angusto duplò brevioribus, racemo paucifloro, laciniis calycinis brevissimis obtusis, petalis oblongis, foraminibus antherarum tubulosis, stigmate clavato: disco elongato 5-lobo.

4. *P. occidentalis*, foliis subrotundis membranaceis obsoletè denticulatis petiolo simplici duplò longioribus, racemo paucifloro, laciniis calycinis oblongis obtusis, stigmatis disco 5-lobo.

5. *P. elliptica*, foliis ellipticis ovatisve membranaceis serrulatis petiolo dilatato longioribus, racemo paucifloro, bracteis lanceolato-subulatis apice recurvis, laciniis calycinis brevissimis: mucronulo recurvo, petalis ovalibus, stigmate clavato: disco elongato 5-lobo.

6. *P. dentata*, foliis cuneato-oblongis coriaceis basi acutis margine remotè dentatis integerrimisve petiolo angusto duplò longioribus, racemo elongato multifloro subsecundo, petalis ovalibus, stigmatis disco elongato 5-lobo.

7. *P. picta*, foliis ovalibus mucronulatis coriaceis subserratis petiolo angusto æquantibus subtùs rubris suprà fasciis pallidis, racemo plurifloro undiquè verso, petalis subrotundis, stigmate clavato: disco 5-lobo.

8. *P. aphylla*, aphylla; scapo angulato basi crebrè squamoso, racemo multifloro subsecundo, laciniis calycinis ovatis acutis crenulatis, petalis subrotundis, stigmatis disco elongato 5-crenato.

SECT. 2.—*Stamina* erecta, versus pistillum inflexa. *Stylus* decurvus, petalis longior. *Stigma* exannulatum.

Scapi *erecti*. Flores *racemosi*, *globosi*, *penduli*, *undiquè versi*.

9. *P. media*, foliis orbiculatis subrotundo-ovalibusve crenulatis coriaceis petiolo dilatato æquantibus, scapo acutè triquetro spirali, racemo multifloro, laciniis calycinis ovatis acutis, stylo decurvo, stigmate capitato obtusè 5-lobo.

SECT. 3.—*Stamina* erecta. *Stylus* rectus. *Stigma* exannulatum.

Scapi *erecti*. Flores *penduli, racemosi*.

10. *P. minor*, foliis subrotundis ovalibusve coriaceis repando-crenulatis petiolo dilatato longioribus, racemo spicato, bracteis pedicellis multò longioribus, laciniis calycinis brevissimis, stylo incluso, stigmate planiusculo 5-lobo.

11. *P. secunda*, foliis ovatis acutis membranaceis argutè serratis petiolo angusto longioribus, racemo unilaterali, laciniis calycinis rotundatis, petalis oblongis, stylo exserto, stigmate planiusculo 5-lobo.

DIVISIO II.—*Capsulæ valvarum, marginibus tomento destitutis, ab apice dehiscentibus. Foliis ternis verticillatisve. Floribus solitariis, corymbosis umbellatisve.*

SECT. 1.—*Petala* patentia. *Stamina* patentia, per paria approximata, petalis opposita. *Pistillum* rectum.

Folia *terna*. Scapi *uniflori*.

12. P. *uniflora*, flore solitario, antherarum foraminibus elongato-tubulosis, stigmate acutè 5-dentato, foliis orbiculatis serratis.

SECT. 2.—*Chimaphila* (*Chimaza*, BROWN). *Petala* reflexo-patula. *Filamenta* stipitata: *stipitibus* in membranam circinatam supernè dilatatis. *Antherarum foraminibus* elongatis, tubulosis. *Stylus* brevissimus aut ovario immersus. *Stigma* latè orbiculatum: *disco* 5-fisso.

Suffrutices. Folia *terna vel quaterna, sive plura verticillata.* Flores *corymbosi.*

13. P. *umbellata,* foliis cuneato-lanceolatis serratis quaternis senisve, pedunculo pubescente corymbifero, bracteolis lineari-subulatis, appendicibus filamentorum ciliatis, stylo immerso.

14. P. *maculata,* foliis lanceolatis acuminatis inciso-serratis discoloribus oppositis ternisve, pedunculo pubescente corymbifero, bracteolis linearibus, appendicibus filamentorum lanatis, stylo brevissimo.

15. P. *Menziesii,* foliis alternis ternisve lanceolatis acuminatis serratis discoloribus, pedunculo glabro bifloro, bracteolis latè rotundatis, laciniis calycinis ellipticis acutis, stylo distincto.

HISTORIA SPECIERUM.

Divisio Prima.

Sect. I.

1. P. *rotundifolia,* foliis subrotundis integerrimis crenulatisve petiolo dilatato brevioribus, scapo triquetro, laciniis calycinis lanceolatis acutis, stigmate clavato obtusè 5-dentato.

P. rotundifolia, Linn. Sp. Plant. 567. — Pall. it. 3. p. 287.—Poll. pal. n. 395.—Georgii Fl. baikal. p. 214.—Fl. Kamtsch. in Arct. Zool. p. 195.—Retz. Obs. 1. p. 17.—Hoffm. germ. 143.—Krocker Siles. 2. p. 12.—Roth. germ. 1. 181. 11. 462.—Willd. Sp. Pl. 2. p. 621. (exclus. synon. Fl. Dan. et Blackw. t. 594.)—Smith, brit. 2. p. 444. (exclus. synon. Fl. Dan. et Raii Synop.)—Eng. Bot. t. 213.—Lam. Encycl. 5. p. 741.—Illust. t. 367. fig. 1. (mala).—Mich. Amer. 1. p. 251. —Persoon, Syn. 1. 483.—Wahlenb. lappon. 110. ejusd. Fl. Carpath. 114.—Pursh, Amer. Sept. 1. p. 299.—De Cand. Syn. Fl. Gall. 249.

P. grandiflora, Bad. Diss. p. 27, t. 3, f. 2.
P. staminibus adscendentibus, pistillo declinato, Linn. Suec. 330.—Mat. Med. 212.—Amœn. Acad. 1. p. 156.—Gmel. Sib. 4. p. 128. n. 15.
P. staminibus et pistillis declinatis, Fl. Lapp. 169.
P. foliis subrotundis, tubis recurvis, Hall. Helv. n. 1010.
P. foliis integerrimis, Vir. cliff. 37.—Roy. lugdb. 440.
P. foliis subrotundis, scapo racemoso, Hort. Cliff. 162.
P. rotundifolia major, Bauh. pin. 191. Hist. 3. p. 2. 535.
Pyrola, Ger. em. 408.—Camer. Epit. 723.
P. folio rotundo, Riv. t. 137. (benè), et t. 136. fig. 2. (optima).
P. vulgatior, Clus. Hist. 2. 116.—Moris. sect. 12, t. 10. f. 1.
Limonium, Fuchs. Hist. 467.
Limonium sylvestre, Frag. Hist. 707.

Round-leaved Wintergreen.

Habitat in dumetis ac sylvis antiquissimis montosis Asiæ, Europæ, et Americæ Borealis. ♃. (v. v. c. et s. sp.)

Radix latè repens. *Folia* pluria, alterna, erecta, subrotunda vel subrotundo-ovalia, obtusissima, coriacea, integerrima s. remotè crenulata, glabra, lucida. *Petiola* dilatati, 2–3 pollices longi, margine membranacei, paginâ foliorum sæpiùs duplò longiores. *Scapi* solitarii, palmares v. spithamei, s. rariùs ultrà, erecti haud convoluti, triquetri, squamis 2–3 lanceolatis acutis muniti. *Racemus* erectus, elongatus, 10–16-florus. *Pedicelli* subremoti, recurvati, undiquè versi. *Bracteæ* ovato-lanceolatæ, mucronatæ, scariosæ, fuscæ, pedicellis longiores. *Flores* campanulati, majusculi, lactei. *Calycis laciniæ* lanceolatæ, acutæ, petalis paulò breviores. *Petala* orbiculata, subcarnosa. *Stamina* adscendentia, petalis breviora: *filamenta* glabra, albo-virescentia, basi latè dilatata; *antheræ* flavæ, foraminibus sessilibus aperientes. *Pistillum* petalis duplò longius; *stylus* declinatus, incrassatus, recurvus: *stigma* supernè assurgens, annulatum: *disco* convexo, subrotato, obtusè 5-dentato.

The present species is much the largest of the whole genus. The leaves are round, or roundish-oval, coriaceous, entire, or crenulated; the petioles are flat, and dilated often

twice the length of the leaves. The scape is triquetrous, never convolute. The raceme is erect, elongated, 12 to 16 flowered; flowers distant, cernuous, white, without any tinge of red, larger than those of P. *media*, emitting a fragrant smell, particularly in serene warm weather. The P. *rotundifolia* has very frequently been confounded with the *media* of SWARTZ, which is much the most common, at least in Great Britain. The figures of *Flora Danica*, and BLACKWELL, and the synonym of RAY, and perhaps also those of HUDSON and WITHERING, belong to P. *media*. The P. *rotundifolia* is certainly not found in the places enumerated by the two last-mentioned authors, but only P. *media* and *minor*. It differs from *media* by its longer stamens, which are directed to the upper part of the corolla; its style being twice longer, declined, with a thickened recurved apex; the stigma being annulate, with a 5-toothed disk; the laciniæ of the calyx being lanceolate; the petals being white, without any tinge of red. The scape is never convolute, as in *media*. The leaves often scarcely exceed in length the half of the petioles. In the figure in English Botany, the flowers are erroneously made to spread too much, and the petals acute: the petioles also are quite too short.

2. P. *asarifolia*, foliis reniformibus coriaceis repando-crenatis petiolo dilatato duplò brevioribus, scapo acutè triquetro, racemo multifloro, laciniis calycinis ovatis acuminatis appressis, stigmate clavato: disco elongato 5-lobo.

P. asarifolia, Mich. Amer. 1. p. 251.—Lam. Encycl. 5. p. 743.—Persoon, Synop. 1. 488.—Pursh, Amer. Sept. 1. p. 299.

Asarum-leaved Wintergreen.

Habitat in pinetis Canadæ (MICHAUX, PURSH), in sylvis fagorum montosis Pennsylvaniæ. PURSH. ♃. (v. s. in Herb. Lamb.)

Radix repens. *Folia* pluria, sæpiùs reniformia, coriacea, glabra, lucida, repando-crenata. *Petioli* 2–3-unciales, dilatati, margine membranacei, paginâ foliorum duplò longiores. *Scapi* palmares, acutè triquetri v. spithamei, squamis paucis scariosis convolutis instructi. *Racemus* elongatus, multiflorus. *Pedicelli* remoti, undiquè versi. *Bracteæ* lanceolatæ, acuminatæ, pedicellorum longitudine. *Flores* globosi, cernui, albo-virentes, magnitudine P. *rotundifoliæ*. *Calycis laciniæ* ovatæ, acutæ, appressæ. *Petala* orbiculata. *Stamina* adscendentia, petala æquantia: *filamenta* glabra, alba, basi dilatata: *antheræ* flavæ, basi vix fissæ: *foraminibus* sessilibus. *Pistillum* staminibus duplò longius: *stylus* declinatus: apice adscendens, clavatus, annulâ cinctus. *Stigmatis discum* elongatum 5-dentatum.

The leaves of this species appear to me to be subject to some slight variations; but in the true state they are of a reniform shape, nearly about the size and form of those of *Asarum europæum*: this remarkable character, if constant, would alone have been sufficient to distinguish it from every other species. The plant itself, is about the size of P. *rotundifolia*, which it greatly resembles in the figure and disposition of its flowers, which are of a greenish-white colour. The above description is taken from very fine specimens, collected in Upper Canada by the late Mr Pursh, author of the Flora of North America, during his travels in 1815. It is but justice to his memory, as a botanist, to state, that, if he had lived, he intended to publish a Flora of Canada, for which he had collected ample materials: these are now in the possession of A. B. Lambert, Esq. Mr Nuttall, in his little work, has erroneously confounded it with the following species.

3. P. *chlorantha*, foliis orbiculatis retusis obsoletè crenu-

latis petiolo angusto duplò brevioribus, racemo paucifloro, laciniis calycinis brevissimis obtusis, petalis oblongis, foraminibus antherarum tubulosis, stigmate clavato: disco elongato 5-lobo.

P. chlorantha, Swartz, Stock. Trans. 1810. p. 190. t. 5.—Nutt. Gen. Amer. 1. p. 273.—Bart. Fl. Phil. p. 202.
P. convoluta, Bart. Prod. Fl. Phil. p. 50.
P. asarifolia, Rad. Diss. p. 23. t. 4. f. 1. (exclus. synon. Mich.)
P. rotundifolia, β nummularia, Muhl. bat.
P. minor, Pursh, MSS. et fortè Fl. Amer. Sept. 1. p. 299.

Small-leaved Wintergreen.

Habitat in Suecià (SWARTZ), in Canadâ Superiore, PURSH. ♃. (v. s. in Herb. Pursh. nunc in Mus. Lamb.)

Radix repens. *Folia* patentia, subcoriacea, orbiculata, sæpè omnium minima, glabra, lucida, margine obsoletè crenulata, apice retusa. *Petioli* angustè lineares, paginâ foliorum duplò longiores. *Scapi* stricti, palmares, tetragoni, nudi, totum modò squamâ minutâ solitariâ medio instructi. *Racemus* brevis, 5–6-florus. *Pedicelli* decurvati, bracteis lanceolatis acutis longiores, undiquè versi. *Flores* campanulati, magnitudine P. *ellipticæ*, albo-virentes, pendùli. *Calycis dentibus* brevissimis, semi-ovatis, obtusis, appressis. *Petala* oblongo-ovalia, staminibus longiora. *Stamina* adscendentia: *filamentis* glabris, basi dilatatis: *antheris* basi bilobis, foraminibus elongatis tubulosis aperientes. *Pistillum* staminibus duplò longius: *stylus* declinatus, adscendens, supernè incrassatus: *stigma* annulatum, disco elongatum, 5-lobum.

4. P. *occidentalis*, foliis subrotundis membranaceis obsoletè denticulatis petiolo simplici duplò longioribus, racemo paucifloro, laciniis calycinis oblongis obtusis, stigmatis disco 5-lobo.

P. occidentalis, Brown in Herb. Banks.

Habitat in oræ occidentalis Americæ borealis Insulâ Sledge dictâ. NELSON 4. (v. s. in Herb. Banks.)

Radix repens. *Folia* numerosa, subrotunda, membranacea, obsoletè denticulata, reticulatim venosa, duplò minora quàm P. *minore*, utrinque viridia. *Petioli* sesquipollicem longi, paginam foliorum duplò excedentes. *Scapus* erectus, gracilis, filiformis, 5-pollicaris, triqueter. *Racemus* 3—5-florus. *Pedicelli* decurvati, bracteam ovato-oblongam acutam æquantes. *Flores* globosi, penduli, lactei, magnitudine P. *rotundifoliæ*. *Calycis laciniæ* oblongæ, obtusæ, petalis ferè duplò breviores. *Petala* orbiculata, reticulatim venosa, staminibus longiora. *Stamina* erectiuscula: *filamenta* gracilia: *antheræ* breves, foraminibus sessilibus hiantes. *Pistillum* petalis multò longius: *stylus* declinatus, apice incurvus: *stigma* annulatum: *disco* brevi, 5-lobo.

The above species has been determined, and named by Mr BROWN, in the Banksian Herbarium; from excellent specimens collected in Sledge Island, on the north-west coast of America, by Mr DAVID NELSON, an industrious botanist, who accompanied Captain COOK in his third voyage, and who has enriched the Banksian Herbarium with numerous specimens of new plants, collected by him in those regions. It resembles P. *minor* in general habit, but is much smaller, and possesses characters widely different. It cannot be confounded with P. *chlorantha*. The long tubular pores of the antheræ of the latter, with its oblong petals, and very short laciniæ of its calyx, as well as its coriaceous orbicular retuse leaves, and other enumerated distinctive marks, abundantly separate it.

5. P. *elliptica*, foliis ellipticis ovatisve membranaceis serrulatis petiolo dilatato longioribus, racemo paucifloro, bracteis lanceolato-subulatis apice recurvis, laciniis calycinis

brevissimis: mucronulo recurvo, petalis ovalibus, stigmate clavato: disco elongato 5-lobo.

P. elliptica, Nuttall, Pl. Amer. bor. 1. p. 273.—Rad. Diss. p. 81. t. 5. f. 1.
P. ovalifolia, Pursh, MSS.

Oval-leaved Wintergreen.

Habitat in Americæ Septentrion. sylvis, nempè in Philadelphiâ et Novâ Sarniâ (NUTTALL), in Canadiâ utraque PURSH. ♃. (v. s. in Herb. Lamb.)

Radix prorepens. *Folia* pátentia, oblongo-ovalia, obtusa aut rariùs ovata, mucronulata, membranacea, tenuiter serrulata, glabra, lucida, basi attenuata. *Petioli* unciales, aut sæpiùs ultra, paginâ foliorum multò breviores, margine membranaceo-dilatati. *Scapus* erectus, gracilis, acutè triqueter, 5-pollicaris, nudus, nunquam convolutus, squamâ 1 scariosâ juxta basin instructus. *Racemus* 5–6-florus. *Bracteæ* lanceolato-subulatæ, pedicellis breviores, apice recurvatæ. *Pedicelli* decurvi, undique versi, distantes. *Flores* campanulati, minores P. *rotundifoliâ*, albi, odorem gratum spirantes. *Calycis laciniæ* brevissimæ, semi-ovatæ, mucronulatæ: *mucronulo* recurvo. *Petala* ovalia, stamina subæquantia. *Stamina* adscendentia: *filamenta* glabra, basi latè dilatata: *antheræ* flavæ, basi vix fissæ: *foraminibus* sessilibus. *Pistillum* staminibus duplò longius: *stylus* declinato-adscendens, supernè incrassatus: *stigma* clavatum annulâ cinctum, disco elongatum 5-lobum.

The present species is much smaller than P. *rotundifolia*. The leaves are membranaceous, finely serrulated, oblong-oval, sometimes ovate, with an attenuated base, much longer than the petioles. Scape very slender, generally about 5 or 6 inches high. Raceme few-flowered. Laciniæ of the calyx very short, semi-ovate; apices of them, as well as of the bracteæ, mucronulate, recurved. Petals oval, equal to the

stamens in length, which are all directed to the upper part of the corolla. Anthers yellow, opening at the base by two sessile pores. Style declined, apex ascending, double the length of the stamens. Stigma clavate, annulate; with an elevated 5-lobed disk.

6. P. *dentata*, foliis cuneato-oblongis coriaceis basi acutis margine remotè dentatis integerrimisve petiolo angusto duplò longioribus, racemo elongato multifloro subsecundo, petalis ovalibus, stigmatis disco elongato 5-lobo.

P. dentata, Smith in Rees' Encycl.

Cuneiform-leaved Wintergreen.

Habitat in Insulâ oræ occidentalis Americæ Borealis, Nootka dictâ. MENZIES. ♃. (v. s. in Herb. Banks.)

Radix repens. *Folia* conferta, erecta, oblongo-cuneata, coriacea, glabra, nitida, basi acuta utrinque viridia: *marginibus* remotè dentatis integerrimisve. *Petioli* angustè lineares, paginâ foliorum duplò terve breviores. *Scapi* erecti, palmares pedalesve, angulosi, nudi. *Racemus* elongatus, 12–16-florus, secundus, apice cernuus. *Pedicelli* decurvati, bracteas ovato-lanceolatas acutas superantes. *Flores* campanulati, cernui, lactei. *Calycis laciniæ* breves, ovatæ, acutiusculæ. *Petala* latè ovalia. *Stamina* petalis longiora, adscendentia: *filamenta* plana, basi dilatata: *antheræ* luteæ, foraminibus sessilibus urceolatis aperientes. *Pistillum* staminibus longius: *stylus* declinatus, apice incurvus: *stigma* annulatum, disco elongatum, 5-lobum.

This species varies both with entire and dentated leaves. The figure of its leaves alone is sufficient to distinguish it from every other species of the section.

7. P. *picta*, foliis ovalibus mucronulatis coriaceis subserratis petiolo angusto æqualibus subtùs rubris suprà fas-

diis pallidis, racemo plurifloro undique verso, petalis subrotundis, stigmate clavato: disco 5-lobo.

P. picta, Smith in Rees' Encycl.

Two-coloured-leaved Wintergreen.

Habitat in Insulâ oræ occidentalis Americæ Septentrionalis, Nootka dictâ (MENZIES), in montosis Japoniæ, prope urbem Nagasacki. ♃. (v. s. in Herb. Banks. et Lamb.)

Radix repens. *Folia* ovalia, coriacea, mucronulata, subserrata, glabra, subtùs rubra, suprà intensè viridia, ad venas fasciâ pallidâ notata. *Petioli* angusti, sesqui v. biunciales, paginam foliorum subæquantes. *Scapus* erectus, palmaris, acutè triqueter, rubicundus, nunquam convolutus, squamis scariosis munitus. *Racemus* pluriflorus. *Pedicelli* recurvi, undique versi, bracteis lanceolatis acutis breviores; *inferioribus* remotis. *Flores* globosi, campanulati, penduli, albi. *Calycis laciniæ* ovatæ, acutæ, appressæ. *Petala* subrotunda, concava, carnosa. *Stamina* adscendentia, petalis breviora: *filamenta* alba, glabra, basi latè dilatata: *antheræ* flavæ, basi parùm fissæ, foraminibus sessilibus dilatatis hiantes. *Pistillum* staminibus duplò longius: *stylus* declinato-adscendens, supernè crassior; *stigma* clavatum, annulatum: *disco* vix elongato, 5-lobo.

It differs from the preceding, with which it has considerable resemblance; by the form of its leaves, which are oval, mucronulate, red underneath, dark-green on the upper surface, and marked along the veins with whitish bands, as in P. *maculata*; those of the preceding are oblong, cuneiform, toothed towards the apex, or quite entire, green on both sides. The petioles are much longer, equal, and sometimes exceeding the length of the pagina or dilated portion of the leaf. The scape is acutely triquetrous, mostly about a span high. The raceme is fewer flowered. The pedicels are

shorter than the bracteæ. The teeth of the calyx are longer and more acute. The petals broader, and shorter.

The specimens of this species, in the Banksian Herbarium, are from Nootka Island, on the north-west coast of America, where they were collected, along with several other new species, in VANCOUVER's Voyage, by my kind friend A. MENZIES, Esq., an acute and industrious botanist. Those in the Lambertian Herbarium are from Japan, and were taken in a Dutch prize, whose cargo was sold in London: these appear to me not to differ in any material points from those in the Banksian Herbarium.

8. P. *aphylla*, aphylla; scapo angulato basi crebrè squamoso, racemo multifloro subsecundo, laciniis calycinis ovatis acutis crenulatis, petalis subrotundis, stigmatis disco elongato 5-crenato.

P. aphylla, Smith in Rees' Encycl.

Leafless Wintergreen.

Habitat in Insulâ oræ occidentalis Americæ Borealis, Nootka dictâ. MENZIES. γ. (v. s. in Herb. Banks.)

Radix repens, supernè divisa. *Scapi* plures, crassiusculi, palmares s. ultrà, erecti, glabri, angulati. *Folia* nulla, nisi *squamæ* numerosæ, foliaceæ, alternæ, lanceolatæ, acutæ, virides, coriaceæ, integerrimæ; *aliæ* scariosæ, per scapum remotè sparsæ. *Racemus* 8–12-florus, subsecundus. *Pedicelli* decurvati bracteas ovato-lanceolatas acuminatas subæquantes. *Flores* globosi, penduli, lactei. *Calycis laciniæ* ovatæ, acutæ, crenulatæ. *Petala* subrotunda. *Stamina* adscendentia, petalis multò longiora: *filamenta* plana, basi dilatata: *antheræ* oblongæ, flavæ, foraminibus dilatatis brevè tubulosis aperientes. *Pistillum* staminibus longius: *stylus* declinato-adscendens: *stigma* annulatum, disco elongatum, 5-lobum.

This remarkable species, although wholly destitute of real leaves, is not, strictly speaking, leafless; their place is supplied by a kind of foliaceous scales, of a greenish colour, coriaceous, lanceolate, acute, entire. In some of the fine specimens preserved in the Banksian Herbarium, an approach to leaves may be distinctly observed. This circumstance appears to me to confirm the opinion entertained by some botanists respecting the nature of the scales on the scapes of *Monotropa*, *Orobanche*, *Orchides*, &c. considering them as analogous to leaves, or, more properly, abortive ones.

SECT. 2.

9. P. *media*, foliis orbiculatis subrotundo-ovalibusve crenulatis coriaceis petiolo dilatato æquantibus, scapo acutè triquetro spirali, racemo multifloro, laciniis calycinis ovatis acutis, stylo decurvo, stigmate capitato obtusè 5-lobo.

P. media, Swartz in Act. Holm. 1804, p. 257. t. 7.—Engl. Bot. t. 1945. (bona).—Smith, Comp. Fl. Brit. 65.—Rad. Diss. p. 21. t. 3.
P. rotundifolia, Fl. Dan. t. 110.—Blackw. t. 594.—Huds. Angl. p. 175. —Lightf. Scot. 1. p. 218.—With. Brit. 1. p. 400.
Pyrola, Raii Synop. 363.
Pyrola folio obtuso, Riv. t. 138. (bona).

Intermediate Wintergreen.

Habitat in dumetis et sylvis Sueciæ, et Angliæ borealis; necnon in ericetis, sylvis et dumetis præsertim montosis Scotiæ copiosissimè. ♃. (v. v. sp.)

Radix latè repens. *Folia* numerosa, patentia, orbiculata vel subrotundo-ovalia, plana, crenulata, coriacea, glabra, nitida. *Petioli* plani, dilatati, paginam foliorum æquantes. *Scapus* erectus, acutè triqueter, spiralitèr convolutus præsertim versus apicem, sæpiùs palmaris. *Racemus* brevis, densus, 12—16 florus. *Pedicelli* decurvati, undique versi,

bracteis lanceolatis acutis longiores. *Flores* globosi, penduli, albi, roseo tincti, multò majores P. *minore*. *Calycis laciniæ* ovatæ, acutæ. *Petala* lata, orbiculata. *Stamina* erecta, versus pistillum semper inflexa, petalis breviora: *filamenta* subulata, basi non dilatata: *antheræ* ovatæ, flavæ, foraminibus sessilibus dilatatis hiantes. *Pistillum* petalis longius: *stylus* decurvus nunquam adscendens: *stigma* capitatum, obtusè 5-lobum, disco depressum.

This plant, which the older botanists, and some of our modern writers, confounded sometimes with *minor*, sometimes with *rotundifolia*, was first ascertained by the accurate Swartz, who has given an excellent description and figure of it in the Stockholm Transactions for 1804. Notwithstanding the length of time since, and the accurate description and figure there given, very few botanical writers have adopted it since that period. This is the more remarkable, as no species can be more distinct. It differs from *rotundifolia* by its shorter style, which is curved downwards, not declined and ascending as in *rotundifolia*, of an equal thickness. The stigma is exannulate, capitate, 5-lobed, depressed in the centre. The stamens are erect, shorter than the petals, and regularly inflected towards the style. The petals are white, tinged with pink. The laciniæ of the calyx are ovate, acute. The flowers are globose, in a much closer and shorter raceme. The scape is acutely triquetrous, and spirally twisted. The petioles seldom exceed the length of the leaf.

Sect. 3.

10. P. *minor*, foliis subrotundis ovalibusve coriaceis repando-crenulatis petiolo dilatato longioribus, racemo spicato bracteis pedicellis multò longioribus, laciniis calycinis brevissimis, stylo incluso, stigmate planiusculo 5-lobo.

P. minor, Linn. Sp. Plant. 567.—Gort. Ingr. 65.—Georgii Fl. Balk. p. 214.—Scop. Carn. 484.—Pall. Pal. 396.—Fl. Dan. t. 55. (fig. med.) —Kniph. Cent. 2. 82.—Hoffm. Germ. 143.—Mat. Sil. 1. 293.—Krocker. Siles. 2. p. 13.—Roth. Germ. I. 181. II. 463.—Willd. Sp. Pl. 2. p. 621.—With. Britt. 401.—Smith, Brit. 2. p. 444.—Engl. Bot. t. 158. (pessima.)—Huds. Angl. 176.—Lam. Encycl. 5. p. 742.—Retz Obs. 1. p. 17.—Lam. Fl. Franc. 2. p. 530.—Persoon Synop. I. 488. —Marsch. a Bieb. Fl. Taur. Cauc. I. p. 312.—Wahl. Lappon. p. 110. ejusd. Fl. Carpath. p. 115.—Rad. Diss. p. 15. t. 1.

P. rosea, Engl. Bot. 2543. (bona), Smith.—Comp. Fl. Brit. 65.—Rad. Diss. p. 18. t. 2.

P. rotundifolia, Pall. Ind. Taur.

P. floribus racemosis dispersis, staminibus pistillisque rectis, Linn. Fl. Gotl. 206. Suec. 331.—Gmel. Sib. 4. p. 128. n. 16. t. 56. f. 1.

P. foliis subrotundis, scapo undique racemoso, genitalibus rectis, Act. Stockh. 1741, p. 192.

P. foliis subrotundis, tubis rectis, Hall. Helv. n. 1009.

P. minor, Riv. t. 136. fig. 1. (bona.)—Dill. in Rail Synop. 363.

Lesser Wintergreen.

Habitat in Europæ frigidioris ericetis, dumetis atque sylvis; in Asiâ septentrionali, rariùs. ♃. (v. v. sp.)

Radix latè repens. *Folia* numerosa, patentia, subrotundo-ovalia vel elliptica, coriacea, glabra, lucida, viridia, margine repando-crenulata, apice mucronulata. *Petioli* unciales aut sæpiùs ultra, dilatati, paginâ foliorum breviores, margine membranacei. *Scapi* erecti, 3—4-pollicares, quadrangulares, medio squamâ lanceolatâ membranaceâ instructi, haùd convoluti. *Racemus* spicatus, densus, 12–14-florus. *Pedicelli* decurvi, bracteis lanceolatis acuminatis multò breviores. *Flores* globosi, penduli, albi roseo tincti: *ore* coarctato. *Calycis laciniæ* brevissimæ, semiovatæ, acutæ. *Petala* orbiculata, genitalibus longiora. *Stamina* primò basi reclinata, demùm erectentia: *filamenta* brevia, albæ, æqualia: *antheræ* subcordatæ, flavæ, foraminibus sessilibus latissimis approximatis aperientes. *Pistillum* stamina æquans: *stylus* rectus, brevis: *stigma* peltatum, planiusculum, rotato-5-lobum.

The P. *minor* is readily distinguished from P. *media* by its straight style, equal the length of the stamens, and

shorter than the petals; by its spiked and closer raceme; the pedicels being twice or three times shorter than the bracteæ; the scape being straight, not convolute; the petioles being shorter than the leaves, which are repandly crenate.

The acute RIVIN has given very accurate figures of the different species of *Pyrola*, far surpassing those of his predecessors, and even those of most of the modern botanical writers who have noticed them. He was the first who distinguished the P. *media*, of which he has given a very characteristic figure, under the name of P. *folio obtuso*.

The figure of P. *minor*, in English Botany, possesses many glaring faults; the flowers are exhibited as spreading, and the petals acute. These mistakes are the more remarkable, as we know of no *Pyrola* with acute petals, and very few with spreading flowers. The P. *rosea* of the same work, however, is a very good representation of the present plant.

11. P. *secunda*, foliis ovatis acutis membranaceis argutè serratis petiolo angusto longioribus, racemo unilaterali, laciniis calycinis rotundatis, petalis oblongis, stylo exserto, stigmate planiusculo 5-lobo.

P. secunda, Linn.—Sp. Plant. 567.—Pall. it. Sib. S. p. 319.—Falk. Russis. Tepog. 2. p. 177.—Scop. Carn. n. 485.—Poll. Pal. n. 397.—Fl. Dan. t. 402. (mala.)—Huds. Angl. 176.—Lightf. Scot. p. 219.—Olaus it. Island. p. 814.—Hoffm. Germ. 143.—Mat. Siles. 1. 293.—Krocker, Siles. 2. p. 13.—Roth. Germ. I. 181. II. 463.—Willd. Sp. Pl. 2. p. 621.—With. Brit. 401.—Smith Brit. 2. p. 445.—Engl. Bot. t. 517. (media.)—Mich. Amer. 1. p. 250.—Lam. Fl. Fr. 2. p. 529.—Lam. Encycl. 5. p. 742.—Persoon Syn. 1. 483.—Marsch. a Bieb. Fl. Taur.-Cauc. 1. p. 313.—Geners. Elench. n. 361.—Besser. Galiz. n. 489.—Wahlenb. Lapp. p. 110. ejusd. Fl. Carpath. p. 115.—Pursh Amer. Sept. 1. p. 299.

P. racemo unilaterali, Linn. Suec. 332.—Hall. Helv. n. 1008.—Gmel. Sib. 4. p. 129. t. 56. f. 2. (pessima.)

P. floribus uno versu sparsis, Linn. Lappon. 168.

P. folio mucronato, Riv. t. 138. f. 2.

P. folio mucronato serrato, C. Bauh. Pin. 181.—Tournef. Inst. 256.—Raii Synop. 363.—Moris. Hist. 1. sect. 12. t. 10. f. 4.

P. folio serrato, J. Bauh. Hist. 3. p. 2. 536.

P. secunda tenerior, Clus. Hist. 2. p. 117. (fig. benè.)—Ger. em. 406.

Ambrosia montana, Dalech. Hist. 1148.

Serrated-leaved Wintergreen.

Habitat in dumetis et sylvis alpinis præsertim pinetis muscosis siccis, Europæ, Asiæ et Americæ borealis copiosè. ♄. (v. v. sp.)

Radix repens. *Caules* plures, 3—4-unciales, sublignosi. *Folia* ovata, acuta cum mucronulo, tenuitèr ac argutè serrata, submembranacea, glabra, supra lucida, venis reticulatis conspicua, nunc basi acuta, nunc rotundata. *Petioli* unciales, angustè lineares, simplices, paginâ foliorum breviores. *Pedunculus* erectus, obtusè angulatus, 3—5-pollicaris, squamis 4 v. 5 oblongo-ovatis margine scariosis crispulatis instructus. *Racemus* elongatus, multiflorus. *Pedicelli* unilaterales, decurvato-penduli, bracteis oblongis acutis vix longiores. *Flores* campanulati, albi, viridi pallido tincti. *Calycis laciniæ* brevissimæ, rotundatæ, obtusæ, margine membranaceæ, laceratæ. *Petala* oblonga, stamina subæquantia. *Filamenta* subulata, alba, primò bicurvata, demùm erectentia. *Antheræ* subtetragonæ, 4-sulcæ, foraminibus sessilibus latissimis aperientes. *Stylus* semper porrectus, staminibus petalisque longior. *Stigma* planiusculum, 5-lobum, disco depressum.

Divisio Secunda.

Sect. 1.

12. P. *uniflora*, flore solitario, antherarum foraminibus elongato-tubulosis, stigmate acutè 5-dentato, foliis orbiculatis serratis.

P. uniflora, Linn.—Sp. Plant. 568.—Pall. it. 3. p. 287.—Gort. Ingr. 66.—Georgi Fl. Baikal. p. 124.—Scop. Carn. n. 486.—Poll. Pal. n. 399.—Fl. Dan. t. 8. (bona.)—Hoffm. Germ. 144.—Mat. Silcs. 1. 296.—Krocker Siles. 2. p. 15.—Roth. Germ. I. 181. II. 464.—Willd. Sp. Pl. 2. p. 622.—With. Brit. 401.—Smith Brit. 2. p. 446.—Engl. Bot. t. 146. (media.)—Mich. Amer. 1. p. 251.—Lam. Fl. Franc. 2. p. 529.—Lam. Encycl. 5. p. 743.—Persoon Synop. 1. 483.—Geners. Elench.

n. 363. Besser. Gáliz. n. 490.—Wahlenb. Lappon. p. 110. ejusd. Fl. Carpath. p. 115.—Pursh Amer. Sept. 1. p. 299.
P. scapo unifloro, Linn. Fl. Lapp. 167.—Suec. 334.—Gmel. Sib. 4. p. 129. n. 19.—Hall. Helv. 1011. it. Hercyn. n. 21.
P. rotundifolia minor, C. Bauh. Pin. 191.
P. minima alpina, J. Bauh. Hist. v. 3. p. 2. 536.
P. singulari flore ampliore, Moris. Hist. 3. p. 505. sect 12. t. 10. f. 2. (benè.)
P. flōre singulari, Riv. Pent. Irreg. t. 139. f. 1. (bona.)
P. quarta minima, Clus. Hist. v. 2. 118.—Ger. em. 408.

Single-flowered Wintergreen.

Habitat in sylvis alpinis muscosis Europæ, Asiæ et Americæ Septentrionalis copiosè. ♃. (v. sp.)

Planta omnibus minor. *Radix* repens. *Folia* patentia, terna rariùs quaterna, orbiculata, membranacea, glabra, serrata, reticulatim venosa, petiolo dilatato longiora. *Scapus* erectus, filiformis, gracilis, 3–4 pollicaris, squamâ ovatâ supra medium instructus. *Flos* magnus, solitarius, cernuus, albus, odore fragrantissimo gaudens. *Calycis laciniæ* ovales, obtusæ, petalis triplò breviores. *Petala* latè ovalia, patentia, multinervosa, staminibus duplò longiora. *Stamina* per paria, approximata, recumbentia, petalis opposita: *filamenta* dilatata: *antheræ* farctæ: *foraminibus* elongatis, tubulosis, incurvis. *Pistillum* staminibus longius: *stylus* rectus, crassus: *stigma* magnum, acutè 5-dentatum.

Sect. 2. Chimaphila.

13. *P. umbellata*, foliis cuneato-lanceolatis serratis quaternis senisve, pedunculo pubescente corymbifero, bracteolis lineari-subulatis, appendicibus filamentorum ciliatis, stylo immerso.

P. umbellata, Linn.—Sp. Plant. 568.—Poll. Pal. n. 398.—Hoffm. Germ. 144.—Mat. Siles. 1. n. 295.—Krocker Siles. 2. p. 14.—Roth. Germ. 1. 151. II. 464.—Willd. Sp. Plant. 2. p. 622.—Mich. Amer. 1. p. 251.—Lam. Encycl. 5. p. 744.—Bot. Mag. t. 778. (optima.)—Persoon Synop. 1. 488.
Chimaphila corymbosa, Pursh Amer. Sept. 1. p. 300.
Chimaza umbellata, Brown in Herb. Banks.
P. pedunculis subumbellatus, Linn. Suec. 333.—Gmel. Sib. 4. p. 129. Sib. 4. p. 129. n. 18.
P. folio arbuti, Riv. Pent. t. 139. f. 2. (bona.)

P. fruticans arbuti folio, C. Bauh. Pin. 191.—Tournef. Inst. 256.—Moris. Hist. 3. sect. 12. t. 10. f. 5.
P. fruticans, J. Bauh. 3. p. 536. (icone.)
P. 3. fruticans, Clus. Stirp. Pann. 507.—Hist. p. 117. (icone benè.)

Umbel-flowered Wintergreen.

Habitat in sylvis glareosis et sabulosis Europæ, Asiæ et Americæ frigidioris. ♄. (v. v. c. et s. sp.)

Planta frutescens, sempervirens. *Radix* prorepens. *Caules* erecti, 4-pollicares v. sæpè palmares, teretes, glabri, virides. *Folia* 4—6-verticillata, utrinque viridia, cuneato-lanceolata, coriacea, glabra, lucida, reticulatim venosa, margine e medio ad apicem acutè ac distantèr serrata, petiolis sexies longiora. *Pedunculi* recti, rubescentes, teretes, 3—4-pollicares, 5—6-flori, pube brevissimâ undiquè densè tecti. *Flores* corymbosi, penduli, demùm erectentes, viridi-albi, rubro tincti. *Calycis laciniæ* rotundatæ, margine fimbriatæ. *Petala* 6, orbiculata, concava, imbricatim conniventia, margine tenuissimè ciliata. *Stamina* brevia: *filamenta* subulata, purpurea, stipitata: *stipitum disco* plano circinato, margine ciliato: *antheræ* violaceæ: *foraminibus* tubulosis orâ revolutâ. *Ovarium* viride: *stylus* ovario immersus: *stigma* virens, latè dilatatum, convexum: *disco* 5-fisso.

14. *P. maculata*, foliis lanceolatis acuminatis inciso-serratis discoloribus oppositis ternisve, pedunculo pubescente corymbifero, bracteolis linearibus, appendicibus filamentorum lanatis, stylo brevissimo.

P. maculata, Linn. Sp. Plant. 568.—Mill. Dict. n. 4.—Willd. Sp. Plant. 2. p. 622.—Mich. Amer. 1. p. 251.—Lam. Encycl. 5. p. 743.—Persoon Synop. 1. 483.—Bot. Mag. t. 897. (optima.)
Chimaphila maculata, Pursh Amer. Sept. 1. p. 300.—Nuttall Gen. Plant. Amer. bor. 1. p. 275.
Chimaza maculata, Brown in Herb. Banks.
P. petiolis apice bifloris vel trifloris, Gron. Virg. 48.
P. Marilandica minor, folio mucronato arbuti, Pet. Mus. 675.
P. Mariana, arbuti foliis angustioribus, trifoliata ad medium nervum lineâ albâ utrinque per longitudinem discurrente, Pluk. Mant. 157. t. 349. f. 4.

Spotted Wintergreen.

Habitat in Americæ borealis sylvis arenosis. ♄. (v. v. c. et s. spont.)

Planta suffrutescens, sempervirens. *Radix* prorepens. *Caules* procumbente-adscendentes, 3—4 pollices longi, glabri, teretes, rubri. *Folia* opposita aut quaterna, brevè petiolata, lanceolata, acuminata, basi obtusa, rariùs ovato-lanceolata, coriacea, glabra, lucida, margine inciso-serrata, *serraturis* distantibus, acutis; *paginâ superiore* fasciâ albâ ad nervum medium et venas notatâ; *inferiore* rubrâ. *Pedunculus* cylindricus, pubescens e medio foliorum ortum ducens, 3—4-pollicaris. *Umbella* rariùs corymbus, 2—3-flora. *Pedicelli* uniflori, calycesque rubri, pube brevi glutinosâ tecti, bracteolis linearibus ad medium instructi. *Flores* penduli, candidi. *Petala* subrotunda, concava, ad expansionem reflectentia, margine tenuissimè fimbriata. *Laciniæ calycinæ* rotundato-ovatæ, ciliatæ. *Filamenta* brevia, subulata, viridia stipitata: *stipitum disco* circinato, villosissimo. *Antheræ* luteæ: *foraminibus* tubulosis ora revolutâ. *Ovarium* globosum, viride: *stylus* brevissimus distinctus: *stigma* virens, orbiculatum, convexum: *disco* 5-fisso.

15 P. *Menziesii*, foliis alternis ternisve lanceolatis acuminatis serratis discoloribus, pedunculo glabro bifloro, bracteolis latè rotundatis, laciniis calycinis ellipticis acutis, stylo distincto.

P. Menziesii, Brown in Herb. Banks.

MENZIES's Wintergreen.

Habitat in Americæ orâ boreali-occidentali. MENZIES. ♄. (v. s. in Herb. Banks. et Lamb.)

Planta suffrutescens, sempervirens. *Radix* repens. Caules supernè adscendentes, 2—3 pollices longi, teretes, glabri, rubri. *Folia* lanceolata, acuminata, coriacea, gla-

bra, nitida, brevissimè petiolata, basi subacuta, margine approximato-serrata, suprà intensè viridia, immaculata, subtùs rubra. *Pedunculus* erectus, gracilis, filiformis, sesqui-v. biuncilis, glaberrimus, ruber, apice dichotomus, 2-florus. *Pedicelli* glabri, gracillimi, uniflori, bracteolo latè rotundato infra medium instructi. *Flores* penduli, candidi. *Laciniæ calycinæ* ellipticæ, acutæ, glabræ. *Petala* ovalia ad expansionem reflectentia. *Filamenta* brevia, viridia: *stipitum disco* circinato, barbato. *Antheræ* oblongæ: *foraminibus* tubulosis, ora rectâ haud revolutâ: *stylus* viridis, brevis præcedente duplò longior: *stigma* virens, hemisphæricum: *disco* 5-fisso.

In the Lambertian Herbarium, I had ascertained this to be a species distinct from *P. maculata*; and on examining the genus in the Banksian Herbarium, I was glad to find it confirmed as such, by its being previously determined and named by Mr Brown.

It certainly has a striking resemblance to P. *maculata*, and without careful examination might readily be overlooked for that species. The plant, however, is much smaller. The leaves are somewhat acute at the base, never spotted on the upper surface, and often alternate,—a circumstance which I have never remarked in *maculata*. The peduncles are much slenderer and shorter, quite smooth, never bearing more than two flowers. The laciniæ of the calyx are oblong-ovate, acute, quite smooth, as well as the pedicels. The bracteæ are very different from those of *maculata*, being broad and round. The petals are oval. The appendage of the filaments is not so hairy. The tubular pores of the antheræ have a straight margin, never revolute as in P. *umbellata* and *maculata*. The style is much longer, and somewhat elongated from the germen. The stigma is smaller, and hemispherical.

XIII.—*Descriptions, Characters, and Synonyms of the different Species of the Genus* Larus, *with Critical and Explanatory Remarks.*

By W. Macgillivray, A. M.,

Member of the Medical Society of Aberdeen, and Corresponding Member of the Wernerian Society.

(*Read* 10*th January* 1824.)

THERE is scarcely a genus of birds in which more confusion has reigned than in that which forms the subject of the present memoir. To those versed in the study of birds, and especially to those who have laboured to acquire a knowledge of the species which are found in our own country, no apology is necessary for an attempt to dissipate the uncertainty and doubt which every one experiences on comparing the specimens which he may have procured with the descriptions of authors. To the student alone, it may be necessary to observe, that the species of gulls, forming a very natural genus, and being, in many cases, most closely allied in manners, in colour, and in size,—and, moreover, presenting much particular diversity, chiefly with respect to plumage at different ages, in the same species,—together with a strong general resemblance in different species during the first years,—are very difficult to distinguish by a

mere examination and comparison of specimens, and, still more so, by attempting to refer them to the species established by naturalists.

My object being to exhibit the subject in as clear a light as possible, I shall, in the first place, give a short but circumstantial account of the genus considered individually, and then proceed to the particular species. But previous to this, it will be proper to observe, that the paper, such as it is, owes its existence to Professor JAMESON, who, aware of the uncertainty that prevails in this very interesting genus, wished me to attempt its elucidation. The specimens, which have furnished the principal materials of this necessarily imperfect memoir, form part of the splendid collection of birds in the Museum of the University; the descriptions are in all cases taken from actual specimens, and the specific characters elaborated without any reference to those of authors. For the variations exhibited in the young birds, as well as information on other points, I have trusted implicitly to TEMMINCK and MONTAGU: wherever information has been derived from other sources, it will be faithfully acknowledged.

LARUS, *GULL.*

Natural Generic Character.—Beak of moderate length, straight, compressed, the sides rounded, the edges bent inwards and sharp; the upper mandible declinato-incurvate at the end, sharpish; under mandible forming a prominent angle near the end, at the junction of its crura, obliquely truncate and grooved internally at the tip.

Nostrils lateral, mesial, longitudinal, linear, with the fore-end rounded, open, perforated.

Feet rather slender, moderately long, bare above the knee: tarsi squarish, plates anteriorly, covered behind and at the knee with hexagonal scales; toes, three before, the middle one of moderate length, all palmate to the end, hind toe (sometimes wanting) very small, elevated; claws slightly arcuate, shortish, bluntish, increased interiorly into an edge.

Wings long, the first quill longest, the second nearly equal; scapulars longish.

Tail equal or slightly rounded, of twelve feathers.

Note.—In the larger species the beak is very deep, and the knob or protuberance of the lower mandible very distinct; the beak becomes shallower and more attenuated, and the knob nearly disappears in the smaller species. With regard to the tail, there are two remarkable and opposite exceptions; the one existing in the *Larus Sabini*, which has the tail furcate, like that of a Tern; the other in *L. roseus* *, in which it is subcuneate, the middle feathers being considerably longer, the rest graduated.

Physiognomy.—In their general appearance, the Gulls are intermediate between the diving aquatic birds and the Grallæ, and their manners correspond with this character. The head is large, the beak moderately long, the neck shortish, the body deeper than broad, the wings long, the tail moderate, the feet somewhat slender, and bare a little above the knee. They are clothed with a very fine elastic plumage, plentifully supplied with down. The predominating colours are pure white, pale greyish-blue tinged with purple, deep slate-purple, and various tints of brown. There is no difference between the sexes in point of colour: the females are somewhat smaller.

* The name given *pro tempore* to a new species of gull, discovered by the last Arctic expedition, but which is to receive its proper designation from Dr Richardson.

Manners.—The gulls are in general voracious, noisy and timid birds, which seek their subsistence along the shores or on the surface of the sea. They are incapable of diving, although they swim with ease; and their appearance upon the water is much more elegant than on shore, owing to their peculiar lightness, and the superior agility which they then display. They are much upon the wing; their flight is strong and buoyant; and, when flying, they utter a loud cry, more or less deep or shrill, according to the size of the species, and divided by short intervals. In their state of repose, they contract the neck, and generally draw one foot up. They perform a singular action with their feet upon the sands, patting then repeatedly with considerable celerity, and at the same time retiring backwards: the object of this action is not well understood, though it may be presumed to be the discovery of worms or other animals concealed in the sand. In winter they congregate in large flocks, at the mouths of rivers, or on the sands, as well as in the breeding season, when they form a more promiscuous assemblage.

Food.—Their food consists of every thing indiscriminately that they can obtain, without the exercise of courage or address, from the flesh of dead cetacea to the smallest worm. They break open the shells of crabs with their beaks, and those of cockles, by letting them fall from a sufficient height in the air. As they do not swim, their mode of catching fishes is by darting upon them as they approach the surface; for this purpose they pursue the shoals of herrings and sand-eels (*Ammodytes Tobianus*); but their usual supply of fish is derived from those which are casually thrown upon the beach. Young birds also fall a prey to the larger species. In stormy weather gulls sometimes leave their ordinary haunts, and proceed inland, especially in spring.

time, to pick up the larvæ and worms exposed by the plough.

Breeding.—Nothing is known with precision in regard to the period of incubation. Their nests are composed of dried grass, arranged in a slovenly manner, and deposited in a superficial cavity in the turf, or not unfrequently on the bare rock. The number of eggs is generally three. The young are at first covered with a very fine thick down: they leave the nest very soon after exclusion, and secrete themselves in crevices, or behind stones; but they do not take to the water till they are fully fledged. The young birds are mottled with dull-grey, and brownish; the beak and feet, as well as the iris, are at first dark, and become lighter as the bird advances in age: the full and permanent plumage is not acquired in general till the third year. After this, at the autumnal moulting, the head and neck in many become streaked with pale brown lines, which disappear in spring.

Country.—This genus is not confined to any particular portion of either the Old or New Continent, being found everywhere, along the shores, from the frozen regions of the North to those of the South Pole, and appearing equally in the Torrid Zone. Their partial and general migrations have not been sufficiently explained.

Uses.—In the economy of Nature, one of the principal uses of these birds may be to clear the coast of animal remains, which would otherwise produce a noxious effect by putrefaction; in the same manner as the vultures, crows, and eagles, perform this office in the interior of the continents and islands. This may in some degree explain their general diffusion. With regard to man, they do not seem

to be of much immediate importance. Their flesh is tough, generally lean, and disagreeable in taste and flavour: the young and the smaller species, however, are eaten occasionally in the outer Hebrides, and probably in other countries. Their plumage, if it could be procured in sufficient quantity, is much superior to that of most other aquatic birds, for the ordinary purposes to which feathers are applied.

Affinities.—However the Gulls may be placed in the systems of ornithologists, their true position in the system of Nature is evidently between the Petrels or Albatrosses and Terns. There is a striking affinity, on the one hand, between the *Diomedea exulans*, or *Procellaria glacialis*, and the *Larus marinus*, or *argenteus*; and, on the other, between the *Larus Sabini* and *minutus*, and the *Sterna hirundo* and *minuta*. The four genera, in fact, form a very natural family, closely allied in aspect and in manners. The genus *Lestris*, which is by many considered as identical with the present, and by others as at least most closely allied to it, I would not even place within several degrees of affinity.

It has been customary to divide the species of this genus into large and small, giving the former the name of Goelands, and the latter that of Mouettes, terms which have their equivalents in the English words Gulls and Mews. This division, altogether arbitrary, and having no foundation in nature, I would reject. Perhaps a better mode of division might be derived from the prevailing colour of the mantle or back,—or, which would be more eligible, from the form of the tail, which is even, or furcate, or cuneate. In the latter case, however, the second and third divisions would contain but a single species each. It is better to consider the whole as one undivided genus, commencing with the short and deep-billed species, such as *L. bathy-*

rinchus and *marinus*, which are also among the largest,—and ending with those in which the bill is most attenuated, such as *L. minutus* and *roseus*, which are the smallest species of the genus.

1. Larus bathyrinchus, *Great-billed Gull.*

L. rostro pone apicem utrinque gibbo, rubro, dorso alisque ardoisiaceis [1], remigibus caudæque sub apice fasciâ nigris.

Adult.—Beak shortish [2], very deep, much compressed, gibbous in the lateral view both above and below beyond the middle, ochre-yellow to the fore part of the nostrils, bright-red at the end: length $2\frac{5}{8}$ inches, depth at the knob 1 inch. "Irides and corner of the mouth bright scarlet. Feet greenish-yellow [3]," claws blackish-brown; tarsus $2\frac{1}{8}$ inches long, middle-toe [4] $2\frac{5}{8}$ inches. Wings reaching to a little beyond the tip of the tail. Total length $24\frac{5}{4}$ inches, extent 52 inches. Back and wings slate-purple; primaries brownish-black, from the seventh primary to the last secondary quill the tips white, forming a terminal bar, which is broadest in the middle; the rest of the plumage snow-white, with the exception of a band of brownish-black across the tail near the end, including the whole of the feathers, excepting the outer, which have only the shaft slightly marked. Variations dependent upon age, incubation, manners, uses, &c. unknown.

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1 Brown, with a little ash-grey and red, upon a blackish basis.

2 Not quite so long as the head.

3 Parkinson.

4 Including the nail.

Country.—Coasts of New Holland.

Distinctive Characters.—This species, although one of three that are equally black or purple backed, is easily distinguished by the remarkable depth and gibbosity of the beak, as well as by the dark band across the tail.

Synonyms.—*Larus leucomelas*, Temm. Man. d'Ornith. P. ii. p. 760, note.—*L. marinus*, Latham, Ind. Orn. ii. p. 813.—*Black-backed Gull*, Lath. Gen. Syn. vi. p. 371: it being in all probability the species which Parkinson mentions in his Journal, as occurring upon the coast of New Holland; and which Latham, being unacquainted with the *L. bathyrinchus*, as above characterised, naturally supposed to be the following species. Parkinson's words are, "a large black and white Gull, with a bright yellow beak, on the gibbous part of which was a spot of scarlet; the corners of its mouth and irides of the eyes were of a bright scarlet colour, the legs and feet a greenish yellow." Parkinson's Journal, p. 145.

Remarks.—The above description is taken from a specimen in the Museum of the University of Edinburgh, and agrees in all essential respects with that given by Temminck, from a specimen in his own possession. It may not be amiss to subjoin the character as given by himself. "*Larus leucomelas*, Vieill. Beak very strong, short, suddenly bulging toward the end; nostrils ovoidal; the whole plumage of a pure white; mantle and wing black; the tail white, having toward the extremity a broad band of a deep-black colour; primary quills all black; beak yellow, point reddish; feet yellow; length of the tarsus 3 inches. Total length 23 inches." Man. d'Ornith. p. 760, note.

The name *leucomelas* is evidently improper, being equally applicable to this and the two following species, which are all λευκομελανες; *bathyrinchus* expresses the most essential characteristic of the species, and is therefore a better name.

2. Larus marinus, *Carrion Gull.*

L. rostro superne leniter aucto, dorso alisque ardoisiaceis, pennis apice albis, prioribus quinque (vel interdum sex) nigricantibus, alis caudâ brevioribus.

Adult, Winter Plumage.—Beak, shortish, very deep, much compressed, slightly gibbous above, wine-yellow tinged with gamboge, a bright orpiment spot at the knob of the lower mandible; length $2\frac{5}{8}$ inches, depth at the knob $\frac{7}{8}$ths. Naked margin of the eyes red, iris yellow marbled with brown. Feet flesh-colour, claws brownish-black; tarsus 3 inches, middle-toe 3 inches. Wings a little shorter than the tail; total length 28 inches, extent 60 inches. Back and wings slate-purple; quills white at the end; first quill nearly all blackish-brown, this colour extending obliquely inwards to the fifth quill, a small spot on the outer web of which only is black; a whitish mark on the inner webs within the black; shaft of first quill nearly white to the middle, of the others corresponding with the colour of the webs. The rest of the plumage snow-white. A few short longitudinal pale brownish streaks on the back of the head and neck; a number of black bristles about the fore-part of the eye.

Adult, Summer Plumage. — Beak bright yellow, an orange spot on the lower mandible, irides fine yellow, eyelids red-orange, legs flesh-coloured; head and neck pure white; the rest of the plumage as in summer.

N. B. The above description of the adult in winter is from a specimen in the Museum. There is commonly a black bar across the white, at the end of the second quill. The markings of the first primaries vary somewhat, the oblique bar of blackish extending sometimes to the fourth, &c. In one specimen, the largest that I have seen, and apparently a very old bird, the beak was 3 inches long, $1\frac{1}{6}$ deep at the knob; tarsus $3\frac{2}{8}$, toe $3\frac{2}{8}$; total length 28, extent 62.

Nidification, &c.—Breeds along the shores, sometimes (in the outer Hebrides at least) retiring inland to a considerable distance from the sea, to nestle in the islands of lakes. Nest generally made in a superficial cavity in the turf, or sometimes on the bare rock, composed of grass and sea-weeds, with occasionally a few feathers. Eggs, according to Temminck, three or four, of a very deep olive-green, marked with some large and small spots of dark-brown. I have never seen more than three eggs in a nest. In the Islands of Harris, the nests are commonly constructed of the cespitose roots of *Statice Armeria* and dried grass, and are usually pretty perfect.

Young Bird, fully fledged.—Beak deep black; iris and naked circle brown; feet of a livid colour; head and fore-neck greyish-white, with numerous brown spots, largest upon the neck; feathers of the upper parts dark-brown in the middle, edged and tipped with reddish-white; transverse bars of this colour on the wing-coverts, lower parts dull grey, with broad zigzag lines and spots of brown; middle tail-feathers with more black than white, lateral black toward the end, all edged and tipped with whitish; quills blackish, a little white at the tip. Temm.

First Winter Plumage.—Beak bluish black; the extreme tip, and a small portion of the base of the under mandible dusky horn-colour; iris and naked circle brown; feet flesh-colour, tinged with pale blue, inclining to verdigris green about the knee; claws blackish-brown. Head light grey, streaked with pale brown; throat greyish-white; ocular bristles blackish; back confusedly mottled with hair-brown, on a brownish-white basis, tinged with yellow, in patches increasing in size and deepness of tint downwards; wings mottled in the same manner, but the brown deeper, approaching to liver-brown; primaries, primary-coverts, and secondaries, blackish-brown. The arrangement of dark colour on the back is in single spots on each feather, which also prevails on the wing-coverts; but the quill-coverts have the inner webs brown, with processes to the number of four shooting into the light colour of the outer webs, the intervals ash-grey. The bases of the back feathers are pale ash; their edges and tips of the ground colour described above. On the rump and tail-coverts, white predominates; tail-feathers white at the base, with irregular spots and blotches; deep-brown predominates at the end, but is irregularly encroached upon; the side-feathers nearly all white. The whole under-surface whitish, tinged with ash and yellow, with very pale brown spots; under-wing-coverts mottled, brownish-ash and pale brown; axillaries brownish-ash at the base, with irregular bands of pale brown towards the end. The specimen from which this description is taken, is in the possession of Mr John Wilson, and was killed in January 1824.

Second Winter Plumage.—Beak deep-brown, tinged with blue toward the end, the tip horn-colour, the base, especially of the under mandible, yellowish, tinged with brown; angle of the mouth, and naked margins of the eyes yellow-

ish; feet more decidedly flesh-colour; fore part and sides of the head, fore part of the neck, and under surface in general pure white; a few pale brown spots still remaining on the sides, the axillaries, and under wing-coverts nearly as before; ground-colour of the head and hind neck white, slightly tinged with ash, streaked with pale brown; ocular bristles black; back confusedly mottled with pale brown and yellowish-white, tinged with ash and purplish-brown, having somewhat of a transverse direction; there being several bars on each feather, the tips still whitish, those of the scapulars white to a considerable extent; wings deeper than the back, hair-brown, tinged with grey and a little purple, the spots arranged in irregular bars; the tips and intervals reddish-white, tinged with brown; primaries blackish-brown; secondaries pale brown, tinged with grey, and tipped with white; the proximal ones barred with deep brown and whitish at the end; rump and tail-coverts whitish, slightly mottled with pale brown; tail-coverts nearly all white, with a few very deep brownish-black spots and patches; an irregular bar of the same deep brown at the end, the tips whitish. This description is also taken from a specimen, for which I am indebted to Mr JOHN WILSON.

At the age of two years.—After the autumnal moulting, the back and wings begin to assume their deep colour; they are then of a deep purplish-brown, variegated with irregular brown and grey spots; the tail is marbled with brownish; the beak assumes the red spot, with black in the middle; the rest is a livid yellow, patched with black. TEMM.

At the third autumnal moulting, the plumage is completed. TEMM.

Country.—Inhabits the north of Europe and America,

extending from the Arctic Circle to the Temperate regions. Very abundant in the Hebrides, Orkney and Zetland Islands. TEMMINCK observes, that it is common on the coasts of Holland, France, and England, on its passage; but MONTAGU remarks, that it occurs on the coast of Wales at all seasons, which it also does in the Hebrides. According to TEMMINCK, it is seen, though not abundant, on the Mediterranean; and LATHAM makes it extend to the Cape of Good Hope, and even to New Holland; but whatever the Cape bird may be, the New Holland one is undoubtedly the *L. bathyrinchus*.

Manners and Food.—It is generally shy, unless when enticed by food, or in the breeding season. Like the other species, it is commonly seen along the shores, and, when reposing, takes care to choose a place where it cannot readily be surprised, such as a rocky eminence, the middle of an extensive beach, or the bosom of the sea, at a little distance behind the breakers. It flies strongly, and, when soaring, utters a sort of loud, somewhat hoarse cackle, not unlike the sounds of a short laugh. Its common food is fish; but scarcely any thing comes amiss to it, and it also devours young birds. In the outer Hebrides, where it is very abundant, and where its indiscriminating voracity is proverbial, it is often seen searching the hills and heaths for carrion, which it eats in company with the eagle and raven. According to MONTAGU, it is a great enemy to the fishermen, and will tear and devour the largest fish from the hooks, when left dry by the ebbing tide.

Distinctive Characters.—It is distinguished from the preceding species by its superiority in size, by the different form of bill, the want of the black bar on the tail, &c. For

its comparison with the following species, I refer to the distinctive characters of this latter.

Adult Synonyms.—*Larus marinus*, Lin. Syst. Nat. i. p. 225; Gmel. Syst. i. p. 598; Fab. Fauna Græn. p. 102; Lath. Ind. Orn. ii. p. 813; var. *a.*; Temm. Man. d'Orn. ii. p. 760.—*Black-headed Gull*, Lath. Genl. Syn. vi. p. 371; Penn. Brit. Zool. ii. p. 172; Arct. Zool. ii. p. 527.—*Great Black-backed Gull*, Mont. Orn. Dict.—Young. *Wagel Gull*, Lath. Syn. vi. p. 375; Penn. Brit. Zool. ii. p. 182; Arct. Zool. ii. p. 528.—*Larus nævius*, Gmel. Syst. i. p. 598.—*Larus marinus*, var. γ, Lath. Ind. ii. p. 814.

Remarks.—The specific name *marinus*, usually applied to this gull, is a very absurd one, all gulls being essentially *marini*, and this having no claim to a peculiar appropriation of the term. The English name of Black-backed is also a very unfortunate one, as may be seen by referring to the description of the preceding and following species.

3. Larus fuscus. *Dusky Gull.*

L. rostro superne leniter aucto, dorso alisque cinerascenti-ardoisiaceis, pennis apice albis, prioribus quinque nigris, extera sub apice albo notata, alis cauda longioribus.

Adult, Winter-Plumage.—Beak moderate, deep, much compressed, slightly gibbous above, as well as below, lemon-yellow, a bright orpiment spot at the knob; length 2¼ inches, depth of the knob ⅝ths. Naked circle of the eyes red-orange, iris very pale yellow. Feet bright gamboge-yellow, claws brownish-black; tarsus 2¼ inches, toe 2⅝.

Wings about 2 inches longer than the tail. Total length 23 inches, extent 46 inches. Back and wings deep brownish-purple, with a tinge of ash-grey. Four first primaries brownish-black, this colour extending, but diminished in extent, to the sixth or seventh; shafts corresponding with the colour of the webs; a white spot near the end of the first; the rest of the primaries tinged with grey; the whole with more or less white on the tip, sometimes obsolete on the first and second, and very narrow on the next three; secondaries, and some of the scapularies, white at the end; the rest of the plumage pure white; a few longitudinal short streaks of very pale brown on the head and back of the neck.

Adult, Summer Plumage.—The same as in winter, only that the brown streaks have disappeared. TEMM.

Note.—The greater part of the quills are often truncate, with the shaft exserted, in which case the white tip of the primaries is reduced to a mere line. Most authors, and with the rest TEMMINCK, LATHAM, and MONTAGU, describe a spot of white near the end of the first and second quills. In the specimens which I have seen, it was only the first that had this spot.

Nidification.—Nest composed of withered plants, and placed in situations similar to those chosen by the preceding species; according to TEMMINCK on the sands also, or on sand-banks. Eggs two or three, brownish-grey, spotted with black; according to MONTAGU, they are so like those of the *L. argenteus* as not to be distinguishable; that is, dark olive-brown, with dusky blotches. The young, according to MONTAGU, are covered with brown down, mottled with dusky.

Young Bird of the first year.—Beak brown at the base, and black toward the tip; feet dull ochre-yellow. Throat and fore part of the neck whitish, with longitudinal streaks of pale brown; neck and under parts whitish, almost entirely covered with large spots of very deep brown; upper parts and wings, with the feathers blackish-brown in the middle, margined with a narrow yellowish band; tail-feathers at the base pale grey marbled with black, the rest blackish-brown, excepting the tips, which are whitish; quills deep black. TEMM.

Other stages not known with certainty, though they may be inferred to be analogous to those of the preceding species.

Country.—This species is found in summer in all the northern parts of Europe and America; in England, and on the Baltic. In autumn, on its passage southward, is seen on the coasts of France and Holland; more common on the Mediterranean than the preceding species. TEMM.

Manners and Food.—The manners of this species are pretty similar to those of the last. Like it, also, it sometimes proceeds to a considerable distance inland in quest of food. MONTAGU observes, that it is much less numerous than the preceding species.

Distinctive Characters.—In the adult state this species is distinguished from the preceding, by its great inferiority of size, by the greater proportional elongation of the beak, by the bright yellow colour of the feet, those of the other being pale flesh-colour, by the different tint of the back and wings. We have as yet no good distinctive characters between the young of this species and of the *L. argenteus*, which are nearly equal in size. MONTAGU professes to be

unable to discriminate between them; and TEMMINCK passes over the subject in silence. The young of all the large gulls known by the older writers have been variously confounded by them, and indifferently described under various names, such as *Wagel*, *L. nævius*, &c.; all which it were better entirely to forget.

Synonyms.—Adult. *Larus fuscus*, Lath. Ind. Orn. ii. p. 815; would appear to be var. β of *L. marinus* of the same author, Ind. Orn. ii. p. 814; Temm. Man. d'Orn. ii. p. 767.—*Less Black-backed Gull*, Mont. Orn. Dict.—*Silvery Gull*, Lath. Syn. vi. p. 375.

Remarks.—The term *argentatus* signifies properly, not *silvery*, but *silvered*; that is, denotes, not the colour of silver, but a deep brown or blackish colour, with a shade or washing of whitish or light grey upon it. In this sense it is commonly taken by the French naturalists; take, for example, *le Renard argenté* (*Canis argentatus*), the fur of which is described as "*de couleur noir, à laquelle se mêle quelque peu de blanc.*" DESMAR. Looking upon the word *argentatus* in this light, some have applied it as a specific name to the present species. Others, considering it as expressive of a tint resembling that of silver, and observing that this tint does not belong to the species in question, have applied the name of *argentatus* to another species, giving to the present that of *fuscus*. This difference of opinion with regard to the true signification of the term, has given rise to a good deal of confusion. The name of *argentatus* is fully as applicable to the present species as that of *fuscus*; but as TEMMINCK retains the latter, after LINNÆUS and others, it may as well remain.

4. Larus argenteus. *Silvery Gull.*

L. rostro superne leniter aucto, dorso alisque cœrulescenti-perlaceis, pennis apice albis, rectricibus quinque nigris, alis caudâ longioribus.

Adult, Summer Plumage.—Beak moderate, deep, compressed, slightly gibbous above, gamboge-yellow along the edge of the upper mandible, diaphanous at the tip and margins of both mandibles, the rest wine-yellow, a deep reddish-orange spot on the under; angle bright red; length 2 inches, depth $\frac{9}{10}$ths. Iris pale yellow, margin of the eyes yellow. Feet flesh-colour, claws blackish-brown; tarsus $2\frac{1}{4}$ inches long, middle toe $2\frac{5}{4}$. Wings about an inch and a half longer than the tail. Total length 24 inches, extent 50. Back and upper surface of the wings pearl-grey, with a good deal of blue; a broad oblique blackish-brown band passing over the five first quills, so large on the outer as to include nearly the whole, diminishing to the fifth, on which there is merely a bar near the end; second quill with a black bar across the white of the tip; the colour of the shafts corresponding with that of the webs. The rest of the plumage snow-white.

Adult, Winter Plumage.—Head and neck marked with longitudinal streaks of pale brown; in other respects the same as in summer.

Nidification, &c.—Nest in a superficial cavity in the turf, or on the bare rock, along the shores, and especially in rocky islets, composed of withered grass, and sometimes a few feathers, commonly pretty perfect. Eggs 3, placed irregularly, olive-green, sometimes with a good deal of ash-

grey, blotched and spotted with brownish: there is a considerable variation in the ground-colour, as well as in the form of the markings and their tints.

It has not been the custom with ornithologists to observe the young birds before they have left the nest. I have before me a specimen (the examination of which I owe to the liberality of Dr RICHARDSON), from the last expedition under Captain PARRY, which is about a week old, and is marked "Young of *L. argentatus*, 17th August 1821, Duke of York's Bay;" the tip of both mandibles is wine-yellow, the rest of the beak pale brown; the feet dusky, the claws yellowish. The whole body is closely invested with a dense, long, and very soft down, greyish-white on the breast and belly, of a deeper tint on the rest, mottled with brownish-grey, the spots on the head deepest.

Young Bird, fully fledged.—Head, neck, and under parts, deep grey, variegated with numerous spots of pale brown; feathers of the upper parts pale brown in the middle, edged with a narrow reddish band, tail-feathers more brown than white, of the latter colour at the base, all terminated by reddish-yellow; quills blackish-brown, a little white on the tip; beak blackish-brown, iris and circle of the eyes brown; feet of a livid brown. TEMM.

From the first year to the autumn of the second year, all these colours become paler, and the white more extended; the bill remains dusky, the irides get somewhat paler. TEMM. and MONT.

After the second autumnal moulting, the bluish feathers of the back make their appearance; the irides get lighter, inclining to yellow; the beak becomes yellowish at the base, the tail mottled with the terminal bar as at first; the head, neck, and under parts of the body whitish, streaked with dusky. TEMM. and MONT.

At the second spring moulting, the blue of the back and wings is perfected. TEMM.

After the third autumnal moulting, the head and neck still streaked with dusky, and the tail marked with a little dusky down the shafts of the middle feathers. MONT.

At the fourth autumnal moulting, the tail is perfected, and the adult winter plumage complete. TEMM.

At the fourth spring moulting, nothing remained to be perfected, in a specimen kept by MONTAGU, but the point of the bill, which was a little dusky; the head and neck became pure white, as it should do at that season, in the adult. MONT.

Country.—Abundant in all the cold and temperate parts of Europe and America, along the shores, and occasionally appearing along the rivers and on the lakes.

Manners and Food.—This species is more allied in its manners to the smaller than to the larger species, and does not, like the latter, feed upon carrion, but pursues, with the *L. canus*, and others, the shoals of herrings, and frequents the sands, where it picks up worms, asteriæ, cockles, and sand-eels.

Distinctive Characters.—In the adult state, this species can only be confounded with the *L. arcticus*, to which I refer for a minute diagnostic description. The young, before the blue colour of the back appears, are liable to be confounded with those of *L. fuscus* and *L. marinus*, though they may always be distinguished from the latter by their inferiority in size. TEMMINCK does not appear inclined to enter upon this subject, and MONTAGU confesses his inability to distinguish them in a satisfactory manner. This therefore remains one of the desiderata in the history of the genus.

Synonyms.—*Larus argentatus*, Temm. Man. d'Orn. pt. ii. p. 764.—*Herring Gull*, Mont. Orn. Dict.

I am sorry that no more synonyms can be given with certainty: authors have so confounded this, and the *L. fuscus*, as well as others, that it were to little purpose to exhibit a critical view of their blunders.

Remarks.—The adult birds of this species vary considerably in size; the largest which I have seen were 25 inches in length, and the smallest 22. There is also considerable variation in the markings of the outer primaries: in some specimens the black bar of the primaries extends to the sixth, there being a spot on its outer web, but it usually terminates on the fifth. A large portion of the ends of the first and second quills being white, in other specimens there is a spot of black on the outer web of the first, and a bar across the second. In a specimen from the last Arctic Expedition, the primaries are but slightly tipped with white, excepting the first, of which two inches are white, with a small brown mark at the end of the inner web, and a white spot near the end of the second quill. In another specimen, from the same Expedition, the first quill has a large spot of white near the end, beyond which a narrow bar of black, and the tip white; and there is a white spot on the inner web of the second near the end.

The name of *argentatus*, or *silvered*, signifying a dark colour, with a superficial tinge of white, cannot with any propriety be applied to this species; that of *argenteus*, or *silvery*, I have chosen, as nearly allied to the preceding in sound, and, although not by any means peculiarly applicable to this species, yet as sufferable as that of *marinus* applied to another species, and much for the same reason.

5. Larus arcticus. *Northern Gull.*

L. rostro inferne solum aucto, dorso alisque cœrulescenti-perlaceis, pennarum versus apicem spatio magno albo, prioribus quinque albescentibus, alis caudam æquantibus (tarso digitoque 2¼ pollicum longis).

Adult, Summer Plumage.—Beak moderate, deep, compressed, the upper outline without any prominence beyond the nostrils, upper mandible exceeding the under by about ⅜ths of an inch; wine-yellow, diaphanous at the tip and edges, an orpiment-orange spot at the knob; length 2¼ inches, depth ⅝ths. Feet pale flesh-colour; tarsus 2¼ inches, middle toe 2⅛. Wings reaching exactly to the end of the tail. Total length 25½ inches, extent 50. Back and upper surface of wings pure pearl-grey, with a good deal of blue; the outer primaries nearly all white, as well as their shafts, and the tips of all the quills. The rest of the plumage white.

Note.—The above description is from a fine specimen brought by Captain Scoresby *junior*, from the coast of Greenland, in the autumn of 1822, and now in the Museum.

Adult, Winter Plumage, unknown, although from analogy it may be presumed to be distinguished from the summer only by longitudinal streaks of pale brown upon the head and neck.

Young.—There is a specimen in the Museum, which would seem to be the young of this bird; it is from Orkney, and its description is as follows:

Beak 1⅞ in. long, ⅝ths deep, black at the end, dusky,

with yellow tints at the base. Tarsus $2\frac{5}{8}$ long, toe $2\frac{3}{8}$, yellowish, claws brownish-black. Wings a little longer than the tail. Total length 23 inches. The plumage is yellowish-grey, marked with longitudinal streaks of pale brown on the head and neck, transverse zigzags on the back and wings, partly substituted on the tail by irregular spots, and wanting on the first five quills, which are whitish. The under parts are a confused mixture of ash-grey with pale brown and yellowish-white.

Synonyms.—*Larus argentatus*, Captain Sabine, Memoir on the Birds of Greenland, Lin. Trans. vol. xii. pt. i. p. 546; Temm. Man. d'Orn. pt. ii. p. 764.

Remarks.—I can only refer to the above authors with certainty for synonyms. Mr Edmondston, in the Memoirs of the Wernerian Society, vol. iv. p. 501, seems to describe the present species under the name of Iceland Gull, and, in fact, exhibited the bird supposed above to be the young of the first year, as the young of his bird; which, however, differs from mine, and Temminck's and Sabine's Arctic varieties, as they consider them, of the Silvery Gull, in being much smaller in all its proportions. The specimen described above was considered by Mr Scoresby as the true Burgomaster, and named so by him in his last publication; and it is more than probable that the present species is the Burgomaster of navigators, as well as the *Larus glaucus* of Fabricius, Latham, and others. For a fuller discussion of this point, I refer to the remarks upon the following species.

Distinctive Characters.—In point of size, as well as in regard to proportions, this species is nearly allied to the preceding, insomuch that it has been considered by Tem-

MINCK as merely an Arctic variety of it. It differs, however, in the following particulars. The bill has little or no protuberance above, which the *L. argenteus* has, although in a slighter degree; in *L. argenteus*, the upper mandible is very little longer than the under, in *L. arcticus* it is considerably; the nostrils are linear in the former, in the latter much wider, and almost pyriform; the wings are longer than the tail in *argenteus*, of equal length in *arcticus;* in the former, the five first primaries are more or less brownish-black, as well as the shafts, the tips abruptly white; in the latter they are whitish, the bluish colour of the base decreasing gradually, so that a large portion of the tips is pure white, as well as the shafts. There is a much more striking affinity between the present and following species, than between it and the preceding: the distinguishing characters will be pointed out in the next article.

The young of this species are distinguished from those of the following, chiefly by their great inferiority in point of size; they are distinguished from those of all the other great gulls by having no black on the quills or tail, by the greater lightness of the tints and markings, which agree with those of the following species.

6. Larus glacialis. *Greenland Gull.*

L. rostro inferne solum aucto, dorso alisque cœrulescenti-perlaceis, pennarum versus apicem spatio magno albo, prioribus quinque albescentibus, alis caudâ brevioribus (tarso digitoque 3 pollicum longis).

Adult, Winter Plumage.—Beak longish, less compressed than in the preceding species, without gibbosity above, wine-yellow, diaphanous at the tip and edges, an orpiment-

orange spot at the protuberance of the lower mandible; length 3 inches, depth $\frac{7}{8}$ths. Iris pale yellow, angle of the mouth bright red, circle of the eyes straw-yellow. Legs and feet livid flesh-colour, claws blackish-brown; tarsus 3 inches long, toe 3 inches. Total length 31 inches, extent 62. Wings about two inches shorter than the tail. Back and upper surface of wings pearl-grey, with a good deal of blue. Edge of the wing, a considerable portion of the first primaries, and the ends of all the other quills, white; shaft of first primary pure white, of the rest gradually tinged with ash. The rest of the plumage snow-white. Head and neck longitudinally streaked with very pale brown, being along the shaft near the end of the feather.

Note.—The dimensions of the above are from a specimen in the Museum. As this individual is not perfectly adult, having still some pale brown markings on the tail and lower neck, and being thus probably a bird of three years, I have rectified the description of the plumage by the examination of another specimen belonging to Mr Thomas Torrie. Both these are from Shetland, and were shot, and presented by Mr Edmondston. The dimensions of this latter specimen are, beak $2\frac{9}{8}$ inches long, $\frac{7}{8}$ths deep; tarsus $2\frac{5}{4}$, toe $2\frac{5}{4}$; total length 28 inches.

Adult, Summer Plumage.—According to Capt. Sabine, whose description agrees with the above, the head and neck are pure white.

Young. Beak horn-colour to the fore parts of the nostril, the rest brownish-black, length $2\frac{6}{8}$, depth $\frac{6}{8}$ths. (Feet flesh-colour,) claws lightish-brown; tarsus $2\frac{7}{8}$, toe $2\frac{7}{8}$. Total length 30 inches, extent 60. The general ground-colour of the plumage is pale ash-grey, with a little brown and yellow. Head and neck marked with longitudinal streaks of very

pale brown, each of the feathers being of this colour along the shaft near the end. Upper surface in general marked with transverse irregular zigzags of pale brown, deepening toward the tail, each feather being marked with several alternate bands of whitish tinged with ash and yellow, and of pale brown, the tip whitish-yellow. On the tail the bars are partially substituted by irregular spots. Primary quills irregularly marked with small spots. Under surface confusedly mottled with very pale brown, tinged with ash-grey and yellowish-white.

Note.—The above description is made up from a comparison of three different specimens, two of which are in the Museum, and the third is from the last Expedition under Captain PARRY. The two first are British specimens, one of them from Shetland, the other supposed to be from Orkney. In another specimen, also from Shetland, in the possession of Mr THOMAS TORRIE, to whom it was presented by Mr EDMONDSTON, the dimensions and tints were as follows:

Beak $2\frac{6}{8}$ long, $\frac{7}{8}$ths deep; tarsus $2\frac{7}{8}$, toe $2\frac{7}{8}$; length 31, extent 63. In this specimen there is a greater predominance of ash-grey in the tints of the plumage, the inner webs of the quills are nearly pure pearl-grey, and the outer webs of the four first primaries are nearly free of spots. Beak wine-yellow along the edges, tinged with dusky above and below, and brownish-black toward the end.

It is not known whether the above descriptions of the young birds, be of the first or second winter plumage, although from analogy they might be supposed to be of the second, on account of the large proportion of light colour on the beak.

Manners and food.—The only account we have of the manners of this species is that given by Mr EDMONDSTON

of Shetland, in two papers in the fourth volume of the Memoirs of the Wernerian Society of Edinburgh, where he describes it under the name of Iceland Gull. According to his account, it only makes its appearance among the Shetland Isles in winter, coming, as he supposes, from the Arctic regions, about the middle of autumn, and departing toward the end of spring. Its favourite resorts are the entrances of the more exposed bays, or the ocean, a few miles off the land. It is greedy and voracious to a proverb, and seems peculiarly fond of carrion, occasionally entering the bays in quest of it. In its usual deportment it exhibits little of the characteristic vivacity of the smaller species, (a remark which is equally applicable to the *L. marinus*); and does not hover about the sportsman, like them, when shot at, but, when once alarmed, commonly flies off: Mr EDMONDSTON as above.—Its food consists of fish, carrion of all sorts, and young birds: one specimen, Capt. SABINE says, disgorged a little auk when shot, and on dissection another was found in the stomach.

Country.—According to Captain SABINE, they were found very common throughout Davis' Straits and Baffin's Bay, by the Expedition under Captain Ross, in 1818. According to TEMMINCK, it inhabits the most northern countries in general, but in greater numbers toward the east; said to be very common in Russia. It appears in winter in the Shetland Islands, as above. It not being by any means certain that this is the *L. glaucus* of FABRICIUS, &c. little more can be said of its diffusion.

Distinctive Characters.— In a mature state, this species can only be confounded with the preceding, from which it differs chiefly in size, as may be seen by comparing the dimensions given in the descriptions. There is a striking

similarity, however, between the two, so great, indeed, that, at first sight, one might readily take them for the same species. The beak is of nearly the same form, being in both without protuberance on the upper mandible, which is considerably less curved than in any of the other large gulls. The principal points of difference are the following: The nostrils are much narrower than in *L. arcticus*, the whole habit more robust, the head and neck in particular proportionally larger, the bill more elongated, and the wings shorter. It is in the dimensions, however, that we are to look for the most decisive characters; the present bearing to the preceding species much the same relation in this respect that the Raven bears to the Carrion Crow. The young also can only be confounded with those of the preceding species, from which they differ chiefly in size, being much paler than those of any other large species, and without the dark quills and tail of the others.

Synonyms.—*Larus glaucus*, TEMMINCK, Man. d'Ornith. pt. ii. p. 757. *Iceland Gull*, Mr EDMONDSTON, in Memoirs of Wernerian Society, vol. iv. *L. glaucus*, Capt. SABINE, in Linn. Trans. vol. xii. pt. ii. p. 527.

These are the only synonyms to which I can refer with certainty. TEMMINCK and SABINE have thought proper to extend the list. I would remark, in general, of their synonyms, that we cannot be in the slightest degree certain that the authors whom they quote, did not describe the *L. arcticus*. FABRICIUS's account of his *L. glaucus*, for example, accords in all things with our *L. arcticus*; and it is very probable that LATHAM, by his Glaucous Gull, means it also, or has confounded the two; and it is plain that he had no distinct conception of it, from his remark regarding a bird with the primaries black at the end, and from his quoting BRISSON, who, in his *Larus cinereus*, has assuredly

described the summer plumage of *L. argentatus*. The Burgomaster of voyagers is probably more often the *arcticus* than the *glacialis*, and, in many cases, it may signify both. It is therefore a hopeless task to search for synonyms, and highly improper to apply the history of any Glaucous Gull of the older writers to the present species.

Remarks.—The first satisfactory account that we find of this interesting species, is that given in a Memoir on the Birds of Greenland, by Captain EDWARD SABINE, in which he enumerates the species observed by the Expedition under Captain Ross, in 1818. Linn. Trans. vol. xii. p. 527. He there describes it under the name of *Larus glaucus*, Glaucous Gull, observing that it is unquestionably the Burgomaster Gull of the Dutch. This description is sufficiently accurate and circumstantial to remove all doubt with regard to the species. He observes, that from specimens in his brother's possession, he is enabled to render the history of the plumage complete, and, at the same time, to add it to the British Fauna; from which we have to infer that one or more specimens in Mr SABINE's collection are from Shetland or Orkney. This part of the volume was published in 1818.

The very celebrated TEMMINCK, in the second edition of his *Manuel d'Ornithologie*, published in 1820, gives a full account of the species, under the name of *Larus glaucus*, describing it with his usual accuracy and precision, but only in its summer plumage. The length he says is 26 inches, while he also remarks that it is the largest of all the gulls known, yet the length of the *L. marinus* he states at from 26 to 27 inches. Of all the specimens which I have seen, two of which are adult, and four young, there is none so small as this.

A full account of the bird in a mature and young state,

in winter plumage, was afterwards given in the fourth volume of the Memoirs of the Wernerian Society, by Mr EDMONDSTON, a zealous ornithologist of Shetland. Mr E. has two papers on the subject, the first read on the 24th March 1821, the other on the 23d March 1822. His description is fuller than Captain SABINE's, and he also describes its manners as observed in Shetland. In the first memoir, he introduces it as a new species; and in the last remarks definitively, that although it might have previously been obscurely known, it was now for the first time described as a British species; and from the circumstances detailed, it may with propriety receive the name of *Larus Islandicus*, which he had proposed, as both designative of its "Arctic haunts," and commemorative of the "vulgar appellation by which it is known in the Zetland Islands." This Part was published in 1822; but Mr EDMONDSTON alludes to a description made in 1814, which I have not been able to see.

It is still necessary to add a few words with regard to the names of this and the preceding species. It being understood that the Glaucous Gull of the older authors may signify either or both, it would be necessary to restrict the name of Glaucous to one of them, were its application indispensable. But this term Glaucous being equally applicable to three of the larger gulls, and a multitude of the smaller ones, and being, moreover, liable to lead into error, is it not better to adopt names free of all these faults? Of this kind, then, it is presumed, are the names proposed. With regard to the outcry against change of names, I have only to observe, that names, as well as descriptions, must continue to fluctuate until they be rendered of such a nature as to be harmonized with common sense and sound judgment.

XIV.—*Sketch of the Geographical Distribution of Plants in Yorkshire.*

By J. Atkinson, Esq. F. L. S. &c. Leeds.

(*Read 31st May* 1823.)

THE county of York, situate in parallel 53° and 54° N., is not less distinguished for its size than for its varied surface, possessing almost every variety of soil to be found from the level of the sea to the altitude of 2368 feet. Its Flora consists of about 1400 species, of which upwards of 600 are Phænogamous, the remainder Cryptogamous. They may be arranged under the following Natural Orders.

Alismaceæ,	15	Borragineæ,	14	Chenopodeæ,	13
Apocyneæ,	2	Capparides,	5	Cacti,	4
Amaranthaceæ,	2	Cisti,	1	Caryophylleæ,	37
Amentaceæ,	31	Cruciferæ,	34	Caprifoliæ,	9
Amaryllideæ,	6	Cichoraceæ,	24	Convolvulaceæ,	4
Aroideæ,	6	Cynarocephalæ,	14	Campanulaceæ,	6
Asphodeleæ,	8	Corymbiferæ,	40	Dipsaceæ,	9
Aristolochiæ,	1	Cyperaceæ,	34	Ericeæ,	11
Aceræ,	2	Cucurbitaceæ,	1	Euphorbiaceæ,	9
Berberides,	1	Coniferæ,	1	Filices,	28

Gramineæ, - 65	Onagrariæ, - 7	Scrophularinæ, 24
Gentianeæ, - 9	Orobancheæ, - 3	Smilaceæ, - 4
Geraniæ, - 14	Orchideæ, - 18	Saxifrageæ, - 12
Hypericinæ, - 8	Portulaceæ, - 2	Sempervivæ, 13
Hydrocharideæ, 2	Pediculares, - 1	Salicariæ, - 2
Irideæ, - - 2	Papaveraceæ, - 8	Thymelææ, - 1
Junceæ, - - 7	Polygoneæ, - 12	Tiliaceæ, - - 1
Lentibulariæ, 11	Plantagineæ, - 5	Umbelliferæ, 36
Lycopodineæ, 5	Primulaceæ, - 14	Violeæ, - - 8
Leguminosæ, 44	Plumbagineæ, 1	Verbenaceæ, - 1
Labiatæ, - 47	Rhamni, - - 3	Musci, - - 200
Malvaceæ, - 5	Rubiaceæ, - - 11	Lichenes, - 207
Melanthaceæ, 1	Rosaceæ, - - 40	Hepaticæ, - 24
Naiades, - 12	Ranunculaceæ, 28	Algæ, - - 100
Oleinæ, - - 2	Solaneæ, - - 7	Fungi, - 290

May not the general type of the vegetation of a country be considered as indicative of its geology?—Were the Ericæ ever found upon Chalk or Limestone?—Are not the following species always found upon these? Chlora perfoliata, Astragalus glycyphyllos and hypoglottis, Neottia spiralis, Orchis pyramidalis, Cistus helianthemum, &c.? Is not Arenaria verna found on every lead-mine in England? Does not the Pinguicula vulgaris, Vaccinium oxycoccos, Empetrum nigrum, &c. indicate Sandstone? Where can we find a single rare plant on Alluvial soil?

Beginning at the Spurn, and following the coast of Yorkshire as far as Bridlington, and proceeding up the Humber to a little above Hull, including the whole of Holderness—the *vale* of York, and from South Cave to Selby, as well as part of the plain of Cleveland to the Tees, the whole country is composed of *Alluvial* soil: here the botany presents nothing peculiar, having the same plants as the Lowlands of other parts of England. We no sooner cross the

river Ouse, at Selby, than we approach an extensive *Magnesian Limestone* Formation, extending across the county, from Doncaster, Ferrybridge, Kippax, Thorparch, Knaresbro' by Rippon, to the county of Durham: this district is rich in botany. At Kippax may be found, in about a square mile, Orchis morio, mascula, ustulata, militaris, pyramidalis, maculata, conopsea; Habenaria viridis; Ophrys apifera, muscifera; Neottia spiralis; Listera ovata; Allium arenarium, oleraceum: Anthyllis vulneraria; Astragalus glycyphyllos, hypoglottis; Carlina vulgaris; Cerastium arvense; Chironia centaureum; Chlora perfoliata; Cistus helianthemum; Colchicum autumnale; Daphne laureola; Erigeron acre; Galeopsis versicolor; Gentiana amarella; Hedysarum onobrychis; Ornithogalum umbellatum; Potentilla verna; Rhamnus catharticus; Sanguisorba officinalis; Sedum telephium; Pimpinella magna; Antirrhinum minus; Circæa lutetiana; Campanula glomerata, latifolia; Caucalis daucoides; Parnassia palustris, &c. &c. Throughout the whole of this district, most of the above plants are to be found more or less abundant. At Thorparch, a few rare ones may be added; such as, Anemone pulsatilla; Silene noctiflora; Galium tricorne; Asperula cynanchica; Narcissus biflorus; Pyrus aria; Epipactis nidus avis; Actæa spicata; Melica nutans; Chichorium intybus; Carduus eriophorus; Atropa belladonna; Ophrys aranifera? and apifera; Ornithogalum luteum, &c. &c. About Knaresbro', Chara flexilis, hispida; Dipsacus pilosus; Geranium sanguineum; Lepidium latifolium; Silene nutans; Helleborus viridis, &c. Passing over this limestone, which may extend about 10 miles in breadth, from Selby, we approach Leeds; the immediate vicinity of which is all clay. A few plants, not very common, may be found towards Knostrop, near the river Aire, such as, Sisymbrium sylvestre; Cardamine amara; Stellaria nemorum, and Hottonia palustris.

Passing Leeds, to the north, the Sandstone Formation begins. (It contains, in the neighbourhood of Bramley, Woodhouse, Chapelton, &c. many organic remains of vegetables: we have noble specimens of the Phytolithus verrucosus, parmatus, stellatus, striaticulmis, sulciculmis, cancellatus, imbricatus, and tessellatus.) The Sandstone Formation occupies an extensive district, by Otley, as far as Greenhow Hill, where it meets the Compact Limestone: it then passes south, forming a range of alpine moors, by Ilkley, Keighley, and Halifax, to meet the range of the like formation dividing Yorkshire from Lancashire. Many of these heaths are of considerable elevation, as, Bardon Fell, 1663 feet; Draughton Moor, 1074 feet; Foxstone's Moor, 1513 feet; Otley Chevin, 921 feet; Cow Rock Rumbles Moor, 860 feet. The rarer plants are, Botrychium lunaria; Osmunda regalis; Polypodium phegopteris, dryopteris; Aspidium oreopteris, aculeatum, lobatum, dilatatum; Asplenium viride, trichomanes, adiantum nigrum, ruta muraria, Blechnum boreale, Pteris crispa, Cyathea fragilis, Hymenophyllum Tunbridgense, and 80 Musci, all near Halifax: Veronica montana, Scandix odorata, Narcissus pseudo-Narcissus, Pyrola media and minor, Prunus padus, Rubus idæus, chamæmorus; Trollius europæus, Geranium pyrenaicum, Epipactis latifolia, Crocus nudiflorus, &c.

The moors, in general, are clothed with the three species of heath: the Empetrum nigrum, Vaccinium oxycoccos, and Vitis idæa, are also common; the more elevated parts furnishing the Rubus chamæmorus, saxatilis, Lycopodium clavatum, selago, alpinum; and, at the highest part, Arbutus uva ursi.

Retracing our steps to Greenhow Hill, and proceeding north-west, we come to the mountain district of Craven, chiefly consisting of compact limestone. Here we are presented with many most magnificent scenes, equally pleasing

to the lover of landscape and to the botanist. The rocks at Gordale Scar and Malham Cove, rising several hundred feet perpendicular, are probably not to be equalled in England. The mountains are of great elevation: Ingleborough 2368 feet, Pennigent 2281 feet, Great Whernside 2309 feet, West Simon-Seat 1593 feet, Beamsley Rock 1310 feet, Spode Hill Bank 1223 feet, Sutton Crag 1161 feet. Many of the summits of the higher parts of these mountains are covered with sandstone, producing ling and other plants common on that soil. The undisturbed woods, particularly about Bolton Abbey, afford a rich harvest for the botanist. Here trees of great age, and immense magnitude, may be seen literally covered with a profusion of cryptogamous plants, resembling a garden in miniature; Lichens hang in festoons from the branches, whilst the bark is hidden from view by innumerable mosses, on which vegetate Hepaticæ and Filices. The plants upon or near Ingleborough are, Rubus chamæmorus, Actæa spicata, Sedum villosum, Sesleria cœrulea, Poa glauca, Festuca vivipara, Primula farinosa, Polemonium cœruleum, Ophrys cordata, Serapias longifolia, Rhodiola rosea, Convallaria polygonatum, Saxifraga stellaris, oppositifolia; Thalictrum minus, Draba muralis, Thlaspi arvense, Cochlearia officinalis, Geranium sylvaticum, sanguineum, Gnaphalium dioicum, Solida virgo aurea γ, Serapias ensifolia, and rubra. In the district are found, Chara hispida, Galium boreale, Viola lutea, Gentiana campestris, Ornithogalum luteum, Convallaria multiflora, Epilobium alpinum, Polygonum viviparum, Saxifraga aizoides, hypnoides, Stellaria nemorum, Arenaria verna, Potentilla aurea, Geum rivale, Dryas octopetala, Actæa spicata, Thalictrum minus, majus, Trollius europæus, Draba incana, muralis, Thlaspi alpestre, Cochlearia officinalis, Cardamine impatiens, Turritis hirsuta, Geranium phæum, sylvaticum, sanguineum, Hieracium palu-

dosum, Hypochæris maculata, Carduus heterophyllus, Senecio sarracenicus, Satyrium albidum, Ophrys nidus avis, Cypripedium calceolus, Salix myrsinites, herbacea, reticulata; Taxus baccata, Osmunda lunaria, Lycopodium selaginoides, inundatum, alpinum; Asplenium viride, Scolopendrium ceterach, Pteris crispa, Hymenophyllum tunbridgense, &c.

The high range of hills called the Yorkshire Wolds, beginning at the coast near Bridlington, is composed of chalk. This formation extends by Driffield, forming a bow betwixt Beverley and Pocklington to the Humber. In this part the Ericæ are not found. The only rare plants are a few common to limestone, viz. Festuca pumilis, bromoides, Gentiana amarella β, Chlora perfoliata, Astragalus hypoglottis. Passing the Vale of Pickering (lately rendered notorious by the fossil bones discovered in the Kirkdale Cave), we come to the Oölite, extending from Scarborough, by Kirkby Moorside, Hemsley, to meet the Alluvium near Easingwold; it then takes a turn to the east, and passes Malton, and we find on it the following plants: Chara hispida, flexilis, Veronica montana, Utricularia minor, Schænus mariscus, albus, Scirpus pauciflorus, acicularis, sylvaticus, Bromus pinnatus, Arundo epigejos, calamagrostis, Lolium arvense, Elymus europæus, Galium tricorne, Potamogeton gramineum, Viola hirta, lutea, Gentiana pneumonanthe, Bupleurum rotundifolium, Caucalis daucoides, Pimpinella magna, Linum perenne, Drosera Anglica, longifolia, Paris quadrifolia, Pyrola rotundifolia, Potentilla verna, Geum rivale, Papaver hybridum, Ranunculus lingua, parviflorus, &c.

The only district which I have not been able to examine is the Alum-shale, rising on the coast, from Whitby to the Tees, including the Vale of Esk. The small line of Basalt found in Yorkshire, passes through the above.

Plants found in the southern counties of England, which are not in Yorkshire:

Clematis vitalba.
Orobanche minor.
Tamarix Gallica.
Campanula patula.
trachelium.

Northern plants, not found:

Ligusticum scoticum.
Cerastium tetrandrum.
Aira levigata.
Sagina maritima.

Plants which appear to have reached their northern limits:

Butomus umbellatus.
Viscum album.

Plants which appear to have reached their southern limits:

Trientalis europæa.

Native Swiss plants, found in Yorkshire:

Malaxis paludosa.
Cistus marifolius.
Geum rivale.
Ribes petreum.
Thalictrum majus.
Sedum villosum.
Epilobium alpinum.
Pyrus aria.
Pyrola rotundifolia.
minor.
Stellaria nemorum.
Geranium lucidum.
sanguineum.
Gentiana pneumonanthe.
Osmunda regalis.
Impatiens noli tangere.
Arenaria verna.
Campanula latifolia.
Thlaspi alpestre.
Solidago virgaurea.
Ornithogalum luteum.
Melica nutans.
Sedum Telephium.
Allium arenarium.
Convallaria majalis.
Fumaria claviculata.
Thalictrum minus.
Astragalus hypoglottis.
Lepidium latifolium.

Rare plants, natives of Lapland and Yorkshire:

Rubus chamæmorus.	Salix rosmarinifolia.
Draba incana.	Thalictrum alpinum.
Rhodiola rosea.	Andromeda polifolia.
Tofieldia palustris.	

Rare plants, natives of Switzerland and Yorkshire:

Cerastium alpinum.	Serratula alpina.
Potentilla aurea.	Dryas octopetala.
Bartsia alpina.	Aspidium lonchitis.
Gentiana verna.	Polygonum viviparum.
Viola lutea.	Saxifraga stellaris.
Salix herbacea.	aizoides.
Galium boreale.	Equisetum hyemale.
Lathræa squamaria.	Scandix odorata.
Rubus idæus.	Ribes alpinum.
saxatilis.	Asplenium viride.
Trientalis europæa.	Circæa alpina.
Salix pentandra.	Epilobium angustifolium.
Ophrys cordata.	Narthecium ossifragum.

Rare plants, natives of Lapland, Switzerland, and Yorkshire:

Papaver cambricum.	Asplenium adiantum nigrum.
Salix crowana.	Hymenophyllum tunbridgense,
Alisma natans.	&c.
Scolopendrium ceterach.	
Bartramia arcuata.	

Plants indicative of great altitude:

Arbutus uva ursi,

Hutchin Moor, near Todmordon,	Yorkshire.
Cronkley Fell, - -	Do.
Kinder Scout, - -	Derbyshire.

Dale Head, - - - Westmoreland.
Near Hexham, - - Northumberland.
Martindale, Dale Head, - Cumberland.

Saxifraga oppositifolia,
Ingleborough, Hinklehaugh, and Malham Cove, - - - Yorkshire.
Cader Idris, and other high mountains in - - - Wales.
In a ravine of the Screes, near Wastwater, - - Cumberland.

Rubus chamæmorus,
Ingleborough, Hinklehaugh, Kirby Fell, &c. - - - Yorkshire.
Mountains of Wales, Westmoreland, Cumberland, and Durham.

Plants extremely local.

Dryas octopetala—On Arncliff, Clowder, in Littendale; and near Settle, Yorkshire; and Cronkley Fell *.

Gentiana verna—Found in Teesdale in most surprising quantities, and, luckily, cannot be extirpated, in consequence of its sending out innumerable runners, each of which becomes a plant on digging up specimens. Gardeners from all parts of England have visited this spot, and attempted its destruction, after removing quantities for sale. Goths indeed!

Cypripedium Calceolus—In several parts of Craven, Yorkshire; Castle Eden Dean, Durham; Borough Hall Park, Lancashire.

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* Cronkley Fell is often cited as in Durham, but certainly on the York side of the Tees.

The Ladies' Slipper used to be found in tolerable plenty about Ingleborough; the greediness of florists has, however, rendered it scarce. The great secret in its cultivation appears to be rest. A poor man, in Craven, has made a considerable sum annually by the sale of this plant: he possesses a small garden surrounded with gooseberry trees; in the centre, he planted some years ago some plants of the Cypripedium calceolus; they were left undisturbed for a long period, and have filled the garden, flowering freely, and flourishing under the partial shade of the gooseberry-bushes.

LEEDS,
October 1823.

XV.—*On a new British Species of* Spatangus.

By the Rev. JOHN FLEMING, D. D.
Minister of Flisk.

(*Read 21st March* 1824.)

THE portion of the animal which I am now about to describe, and which appears to constitute an addition to the British Fauna, has been in my possession nearly fourteen years. I formerly alluded to it in the "Contributions to the British Fauna," inserted in the second volume of the Memoirs of this Society, p. 247, as a species nearly allied to the common sort found on all parts of the coast. Indeed, I entertained some suspicions that it might prove only a variety; but having since examined many examples of the common species, and never perceived any approach by gradation to the characters which it exhibits, I can now with some degree of confidence announce it as distinct.

Spatangus ovatus. Groove between the mouth and vertex obsolete. Leske, ap. Klein Ech. p. 252, tab. xlix. f. 12. 13.—Only one specimen occurred in a fishing-boat from the deep sea cod-fishery, Zetland, 1809.—See Plate VI., lower figure.

DESC. Vertex nearly even. Oviducts approximate, with the punctured space behind. Vent transversely ovate. Enclosed space beneath cordiform, with single lateral pores. Primary spines supported on tubercles, with a central ligament, and surrounded by a moniliform ring. Spaces between the pairs of pores in the avenues rough. Colour purple. About an inch and a quarter in length.

I have adopted the appellation from LESKE with very considerable doubt. The Zetlandic species is more globular than expressed in LESKE's figure, and the line from the oviducts to the mouth is flat, instead of being carinate. In other respects, however, there is considerable general resemblance.

The following list contains all the species of Echini which are known to reside in our seas:

I. Genus, CIDARIS.
1. papillata.

II. —— ECHINUS.
2. esculentus.
3. miliaris.
4. subangularis.

III. —— SCUTELLA.
5. placenta.

IV. —— FIBULARIA.
6. pusilla.

V. —— SPATANGUS.
7. cordatus.
8. ovatus.
9. purpureus.

MANSE OF FLISK,
Feb. 6. 1824.